



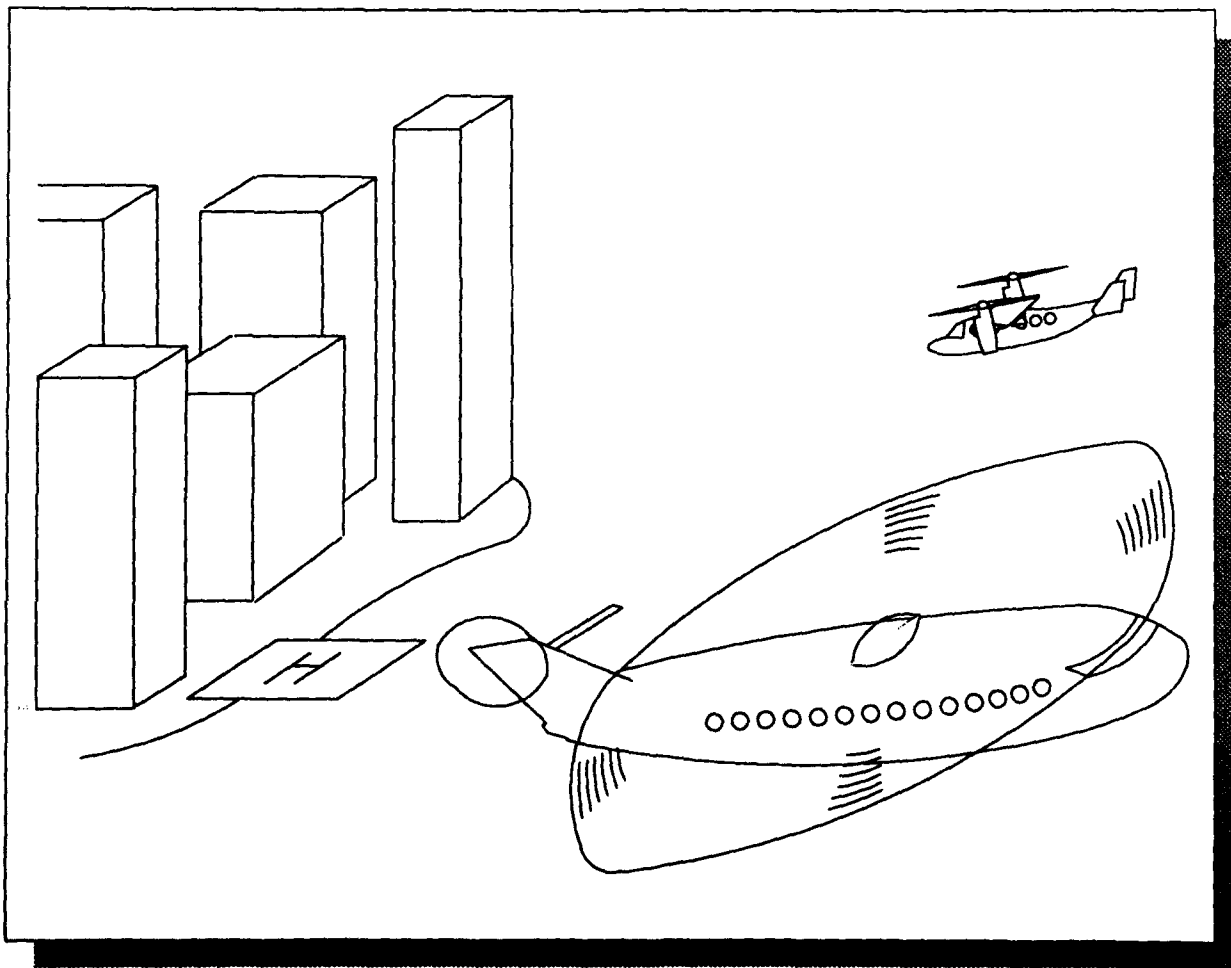
U.S. Department
of Transportation
Federal Aviation
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ROTORCRAFT MASTER PLAN

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U.S. Department
of Transportation
**Federal Aviation
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Office of the Administrator

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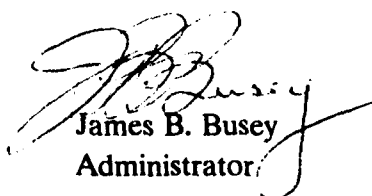
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To The Reader:

I am pleased to issue the updated Rotorcraft Master Plan for 1990. The Plan, in its new format, presents a picture of a healthy industry with potential for major growth. As traffic in the airway system grows faster than the ability to provide additional capacity, rotorcraft may offer the means to relieve some of the increasing congestion at major hub airports. The current test program of the tiltrotor aircraft foretells an exciting new technology which can serve the expanding short- to mid-range travel needs of the flying public while providing a possible solution to capacity problems.

The Rotorcraft Master Plan addresses the contributions of the Federal Aviation Administration (FAA) and private industry toward creating and enhancing a climate in which the rotorcraft industry can continue to expand and realize its full potential. The plan attempts to describe the relationships between FAA and industry research, development, and engineering programs and other activities. More importantly, the plan establishes realistic goals for the FAA and the industry in the areas of rotorcraft infrastructure, aircraft technology, and pilot training and certification. The key to making the plan work, however, rests with the private sector and with local governments. The FAA can certificate rotorcraft, integrate scheduled rotorcraft passenger service into the National Airspace System, and help with vertiports. However, the private sector, along with local governments, must take advantage of the opportunities to achieve commercially successful rotorcraft passenger service.

The FAA looks forward to working with the rotorcraft community to ensure that our American aviation system remains the envy of the world.


James B. Busey
Administrator

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EXECUTIVE SUMMARY

Total rotorcraft operations are expected to double over the next 20 years, with air taxi and business operations leading early growth, and intercity commuter operations expanding in the out years. To support that growth will require adequate infrastructure, advanced aircraft technology, and an expanding supply of trained pilots. The tiltrotor, a proven new vertical lift technology, may play a significant role in establishing intercity commuter operations. Tiltrotors could operate between heliport facilities called vertiports, which are more elaborate and somewhat larger than today's average heliport. This technology has the potential to enhance National Airspace System (NAS) capacity at a fraction of the otherwise necessary investment in new or improved commercial airports.

This vision is based on an overall strategy of positive action by private industry, the FAA, other Federal agencies, and state and local governments to encourage the expansion of rotorcraft operations both in current applications and in scheduled passenger and cargo markets in the 200-500 nautical mile range. By 2010, rotorcraft could provide as much as 10 percent of intercity passenger operations capacity in the NAS.

This potential for rotorcraft to enhance NAS capacity is the underlying rationale for the initiatives presented in this plan. Two assumptions are also implicit in this potential: rotorcraft must provide additional capacity 1) without increasing delays and 2) at a lower cost than building new runways or major commercial airports.

The 1990 Rotorcraft Master Plan (RMP), which covers the period through 2010, was based on information provided by joint FAA and industry groups. The groups reviewed the last RMP (1987) focusing on four major aspects of the rotorcraft environment: public use heliport development,

integration of rotorcraft operations into the NAS, rotorcraft technology, and pilot training and certification. The 1990 RMP is divided into nine chapters and an appendix. Biennial updates of the RMP are planned.

Chapter 1 reviews the history of the RMP and reports on the current state of the rotorcraft industry.

Chapter 2 focuses on recent accomplishments, including:

- o publication of a new FAA Heliport Design Guide,
- o establishment of the FAA Vertical Flight Program Office,
- o definition of projects to prepare the U.S. civil air transportation system for introduction of the civil tiltrotor in 1997—with early demonstrations beginning in 1994,
- o development and publication of several new helicopter route charts, and
- o funding of heliport/vertiport planning and site studies.

Chapter 3 details the goals of the 1990 RMP.

Chapter 4 describes the issues examined by the review groups.

Chapters 5, 6, and 7 present strategies and projects proposed to accomplish the RMP goals. The strategies and projects address three issue areas: infrastructure (heliport and vertiport development, NAS integration), aircraft technology, and pilot training and certification.

Chapter 8 summarizes activities to expedite introduction of a civil tiltrotor aircraft.

Chapter 9 presents special considerations for implementing the RMP, including checkpoints at critical times to validate the need for continued investment in vertical lift transport.

Brief summaries of the projects covered in the plan are contained in the Appendix.

Activities to implement the plan fall into the three broad categories covered in Chapters 5, 6, and 7. To develop the envisioned infrastructure, two major

areas of activity are required: more heliports must be developed, and related routing capabilities--including both instrument flight rules (IFR) and random routes--must be established. Over the next 20 years, the plan envisions development of 500 heliports/vertiports, with 20 to 40 percent of these fully IFR-qualified. Also needed is development of an interconnecting route structure, including terminal instrument procedures (TERPS), communications, navigation, and surveillance (CNS) capabilities, and weather data required for IFR operations. As prerequisites to these improvements, the public image and environmental compatibility of rotorcraft must be enhanced.

In aircraft technology, planned activities support the identification of promising safety-enhancing technologies and the development of certification criteria. Civil tiltrotor certification is highlighted. In addition, work on health and usage monitoring technology and on small, short-term, high-power engines is proposed.

For pilots, improved training and education programs are emphasized, along with the development and certification of advanced simulator technology.

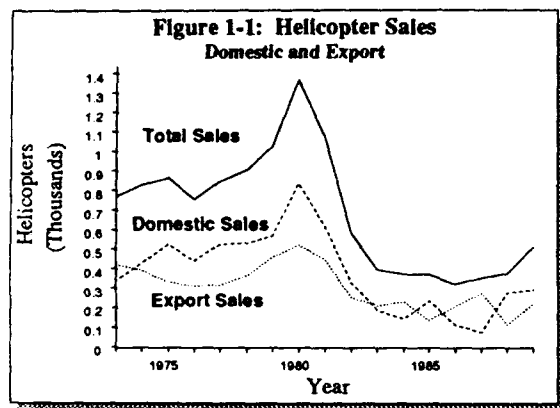
The challenge to industry and the public sector is to coordinate their efforts and reaffirm their commitments to accomplish the objectives of the plan. In so doing, both NAS system capacity and the condition of the entire vertical flight industry will be enhanced.

Chapter 1

INTRODUCTION

Historical Perspective

Rotorcraft industry growth has varied from low levels to near boom proportions over the past 15 years. For example, as shown in Figure 1-1, domestic new helicopter sales peaked at 841 units in 1980.

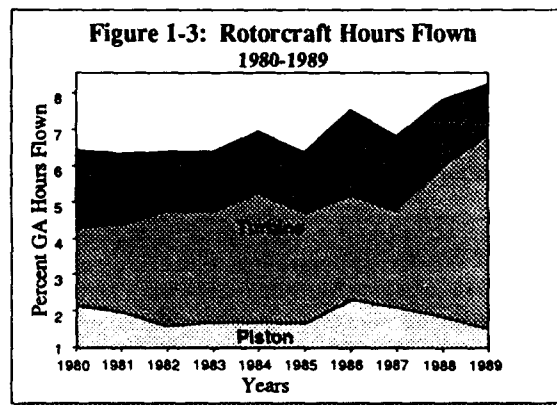
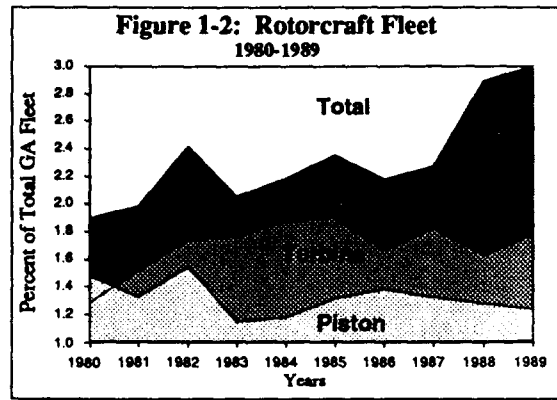


While domestic new sales have declined since 1980, helicopter activity as a proportion of aviation activity has remained about constant.

Figures 1-2 and 1-3 show the rotorcraft fleet and rotorcraft hours flown as percentages of the entire general aviation fleet for the period 1980-89.

Developments in vertical lift technology and expected future limits on conventional take-off and landing capacity are the basis for an expansive projection of future vertical flight activity contained in this plan. Past levels of vertical flight activity are shown in Chapter 3, along with a discussion of forecasts and projections of future fleet, hours flown, and total operations.

In 1975 FAA created the Rotorcraft Task Force to address issues associated with unprecedented growth in the industry. The purpose of the Task Force was to



guide and monitor FAA rotorcraft interests in the areas of operations, policy, and research and development, and to provide an open forum for communication between Government and industry on national rotorcraft issues. As a result of the recommendations of the Rotorcraft Task Force, the FAA formulated a long-term plan of action--the Rotorcraft Master Plan (RMP)--which was published in December 1983. The RMP was updated annually through September 1987.

In 1988 the FAA initiated a comprehensive review of the RMP. The review involved cooperation between the FAA and representatives of the rotorcraft industry, working together to publish a revised RMP in 1990.

Purpose of the Plan

The 1990 RMP coordinates existing programs and new actions needed for vertical lift aircraft to reach their full potential within the NAS. The plan summarizes actions that must be taken to integrate vertical lift aircraft operations into the NAS, consistent with the overall FAA mission to ensure a safe and efficient air transportation system.

Approach

This revised RMP links FAA vertical lift aircraft activities to FAA goals and objectives over a 20-year period. Analysis and recommendations that supported previous versions of the RMP were taken as a starting point.

A comprehensive review of the previous RMP was undertaken during 1988 with the full participation of the rotorcraft community. The review was divided into four working areas: NAS integration, heliports, aircraft certification, and pilot training and certification. Each area was assigned to a working group co-chaired by FAA and industry representatives with appropriate professional expertise. In addition to their assigned areas, the groups also evaluated comprehensive issues relevant to the vertical flight community as a whole.

Results of the RMP Review

The vertical flight community concluded that the current state of the rotorcraft infrastructure--landing facilities, airspace and air traffic regulations and procedures, as well as technology and training certification--does not allow rotorcraft to take full advantage of their inherent operating and mission flexibility. Key requirements for the industry include 1) an improved public image for vertical lift aircraft, 2) a network of public use heliports and vertiports equipped for both visual flight rules (VFR) and instrument flight rules (IFR) operations, 3) regulations and procedures to advance vertical flight safety, 4) more comprehensive statistical information on vertical flight operations, and 5) improvements in pilot and controller training.

Perhaps the most pressing problem today is the lack of

heliports near urban business centers. Helicopters now operate from economically less desirable locations--in some instances, from congested airports where they must be integrated with fixed-wing traffic.

The majority of today's helicopter operations occur in VFR conditions, thereby avoiding direct participation in the air traffic control (ATC) system. This occurs because helicopters are seldom able to optimize their unique operating capabilities within that system. In the future, however, as vertical lift aircraft are used increasingly for commercial passenger operations, both the aircraft and heliports will require IFR capability to maintain schedule reliability and safety. IFR capability is also critical for many other missions, including emergency medical service, law enforcement, and offshore oil resupply.

Chapter 2

RECENT ACCOMPLISHMENTS

Heliports

The Heliport Design Guide was published in January 1988.

The heliport chapter of the Advisory Circular, Planning the State Airport System, has been completed in draft form and is being reviewed prior to publication.

In July 1988 a joint FAA/industry committee was formed to assess design standards for large heliports and vertiports. The draft standard was completed for FAA review in early 1990. The final standard, to be published as an advisory circular, should be completed by the end of 1990. The FAA appointed Regional Heliport Development Coordinators to work with state, local, and regional authorities on heliport and vertiport development.

A total of 69 heliports were included in the latest draft of the National Plan of Integrated Airport Systems, with recommended development funding of \$97 million. The FAA Airport Planning and Programming Office reports that:

- o The Portland, Oregon, heliport was completed and opened in February 1989, and
- o Construction bidding opened in November 1988 for the Garland, Texas, heliport near Dallas.

Several applications to the FAA for vertiport/heliport feasibility study grants were received and the following studies have been funded (through February 1990):

- | | |
|--|-----------|
| o Port Authority of New York and New Jersey (four grants) | \$585,000 |
| o Washington, D.C., Council of Governments (in coordination with PANY studies) | \$80,000 |
| o Southern California Association of Governments (SCAG) | \$120,000 |

- | | |
|-------------------------------|-----------|
| o Alaska | \$261,000 |
| o Dade County, Florida | \$360,000 |
| o Texas | \$200,000 |
| o St. Louis | \$135,000 |
| o Puerto Rico/Caribbean Basin | \$202,500 |
| o Orlando, Florida | \$64,400 |
| o Illinois | \$180,000 |
| o San Francisco | \$315,000 |

In addition to these grants, FAA has made a few, smaller ones bringing the total of all heliport/vertiport grants to date to about \$2.7 million. An application for an FY 1991 heliport systems planning grant is pending from South Dakota, and one is expected from Boston, Massachusetts.

Helicopter Routes

Helicopter route charts are graphic portrayals of discrete or common use helicopter routes and operating zones located in high density traffic areas. These routes are designed to facilitate helicopter operations within those areas. Since publication of the most recent charts for Washington, D.C. (February 1988); Chicago (May 1988); Los Angeles, California (January 1990); and Boston, Massachusetts (April 1989), the chart development process has been formalized as the FAA Helicopter Route Chart Program. Its purpose is to improve operational safety and efficiency in areas where significant helicopter operations occur. It also puts in place a systematic, cooperative (FAA-industry-user-local/state government) process for chart development, modification, and acquisition.

Certification Standards

Notices of Proposed Rulemaking were issued

- o in March and October 1988, updating standards for rotorcraft airframe items and propulsion systems, respectively;
- o in April 1988, covering updates to rotorcraft airworthiness standards common to U.S. and European rotorcraft; and,
- o in May 1988, proposing energy absorption criteria for rotorcraft seats and associated occupant restraint.

Finally, in July 1988 the Interim Airworthiness Criteria for Powered-Lift Transport Category Aircraft were released after updating by joint government and industry teams.

Operating Standards

An Advisory Circular (AC 135-14) was published for Emergency Medical Services/Helicopter (EMS/H) operations. The AC was developed in cooperation with industry, and it provides advisory information on safe operations to current or prospective EMS/H operators.

A new Inspector Handbook (Order 8400.10) on the development of operating, training, and maintenance requirements for EMS/H operators was also issued. Rotorcraft operator flexibility in the case of inoperative equipment was substantially improved by the development and publication of the Single Engine Aircraft Master Minimum Equipment List (MMEL) in August 1988. This MMEL will allow operators to continue safe aircraft operations with specified equipment inoperative.

Civil Tiltrotor

In March 1988, the FAA, the National Aeronautics and Space Administration (NASA), and the Department of Commerce received congressional direction to pursue the development and implementation of a coordinated Civil Tiltrotor Transportation Plan. In June 1988 the FAA Administrator announced that the FAA would lead this effort. The goal is to prepare the U.S. civil air transportation system for introduction of the civil tiltrotor in 1997--with demonstrations beginning as early as 1994.

A five-point program was formally launched on August 12, 1988. The action plan, now underway, includes:

A Memorandum of Agreement between the FAA and the Department of Defense (DOD) to expedite FAA's acquisition of engineering and test data on the military V-22 Osprey tiltrotor. By initiating a parallel effort aimed at civil certification rather than a more conventional sequential process, 5 to 8 years may be saved in certifying civilian tiltrotor aircraft. Applications for civil aircraft certification were received beginning in August 1988, and certification activity is underway.

Accelerating internal FAA tiltrotor certification efforts to meet the 1992 target readiness date. These efforts include airspace review, finalizing aircraft certification standards, developing flight test criteria, and establishing pilot training and certification criteria. The Interim Airworthiness Criteria for Powered-Lift Transport Category Aircraft are being finalized. A cooperative FAA/Navy program for pilot training is being established.

Certification activities have begun; as of early 1990, FAA is receiving relevant certification data under the DOD-FAA Memorandum of Agreement and is identifying critical issues for resolution in the civil certification process.

Establishing an FAA Vertical Flight Program Staff to act as the focal point for FAA civil tiltrotor infrastructure development. The staff also serves as liaison with other Government agencies and industry on civil tiltrotor issues. These agencies include NASA, DOD, the Department of Commerce, the American Helicopter Society, and the Port Authority of New York and New Jersey. The staff has recently been aligned with other vertical flight activities within FAA and is now called the Vertical Flight Program Office.

Increasing FAA R&D activity related to tiltrotor applications. High priority topics include: terminal instrument approach procedures, airborne systems simulation, ATC procedures, and vertiport design standards. As in the past, these efforts will be joint efforts with NASA to assure the full transfer of technology. The Vertiport Design Guide working group is drafting initial guidelines for large heliports and vertiports. Critical aspects of this effort include defining tiltrotor performance and operating procedures for terminal areas and developing one engine inoperative (OEI) approach, landing, and takeoff criteria.

Accelerating the schedule for the planning and development of vertiports. Tied to vertiport development is the application of Microwave Landing System technology that will maximize the flexible operating capabilities of the tiltrotor.

Government/Industry Cooperation

In March 1988 the FAA Technical Center in Atlantic City, New Jersey, hosted an FAA/Industry Rotorcraft Forum. During this forum, the formal process of the Government/industry review of the

RMP was initiated. This RMP is a product of that process. The forum provided information on rotorcraft technology in the 1990's, an overview of heliport and vertiport development, updates on noise and other environmental concerns, and information on FAA accomplishments to date.

In addition, beginning in early 1990, industry has begun sponsoring development of a Civil Rotorcraft Initiative in which efforts similar to those being undertaken for Civil Tiltrotor will be applied on an accelerated basis to helicopter scheduled passenger service. FAA is supporting this initiative through facilitation of FAA activities required to provide needed air traffic and other infrastructure elements for the initiative.

Chapter 3

GOALS

Introduction

Forecasts of vertical lift aircraft activity through the year 2000 show growth in many of the existing missions. With that growth will come 1) increasing demands on the ATC system to separate rotorcraft from other aircraft, especially in congested airspace, and 2) the need for more public use heliports, especially for air taxi and business operations. Ongoing and planned adjustments in the ATC system to accommodate more vertical lift aircraft and an increase in the number of public use heliports will be necessary for the forecast fleet and operations levels to be attained--and for the benefits these levels of activity can bring to the industry to be realized.

At the same time, forecasts of growth in commercial airline passenger operations lead to the conclusion that 34 major commercial airports will be congested by 1997--even if we do all that is currently planned to expand NAS capacity (see Table 3-1). Without additional airspace and airport capacity expansion projects beyond those already planned, this congestion can be expected to worsen. Yet our ability to add capacity is severely limited by both environmental concerns and land availability.

Vertical lift aircraft that provide passenger service between urban landing facilities have the potential to add significantly to system capacity without adding delays--at a small fraction of the otherwise necessary investment in new or improved commercial airports. This potential is the primary rationale for the goals and initiatives in this plan.

Expanding NAS capacity using vertical flight will have other benefits as well: the added landing facilities and ATC adjustments that are put in place will also support--and perhaps expand on--the forecast growth in non-passenger helicopter operations.

Goals

If vertical lift aircraft prove successful in satisfying a significant part of forecast additional demand for scheduled passenger service, their operations could

**Table 3-1: Airport Delay Forecast, 1997
(20,000 Hours or More)**

Atlanta	New York:
Boston	-(Kennedy
Chicago	International)
Charlotte	-(La Guardia)
Cincinnati	-(Newark)
Cleveland	Ontario, CA
Columbus	Orlando
Dallas-Ft. Worth	Philadelphia
Denver	Phoenix
Detroit	Pittsburgh
Honolulu	St. Louis
Houston:	Salt Lake City
-(Hobby)	San Francisco
-(Intercontinental)	San Jose, CA
Las Vegas	Seattle
Los Angeles	Washington, DC:
Memphis	-(Dulles
Miami	International)
Minneapolis/St. Paul	-(National)
Nashville	

Source: U.S. Department of Transportation, Federal Aviation Administration, Office of Aviation Policy and Plans, Fourteenth Annual Aviation Forecast Conference Proceedings, Report No. FAA-APO 89-2, March 1989, pg.30

double during the next 20 years. Air taxi and business operations would be expected to lead early growth, supplemented by scheduled intercity commuter operations in the out years. Supportive infrastructure, aircraft technology, and an adequate supply of trained pilots and mechanics will be required to support this growth. Tiltrotors may play a significant role in intercity commuter operations. The tiltrotor, a proven new vertical lift technology, could operate between vertiports, heliport facilities that are more elaborate and somewhat larger than today's average heliport.

This vision of the potential of vertical flight is the goal on which the remainder of this plan focuses--one toward which both the industry and Government can strive. It is consistent with the three goals that have guided development of previous versions of the RMP:

- o Full rotorcraft integration into the NAS, including nationwide, all-weather, low-altitude, and remote area operations, while ensuring that the unique capabilities of rotorcraft are employed to the maximum practical extent,
- o an adequate system of public use VFR and IFR heliports, and

- o improved safety through upgraded certification criteria and promotion of advanced technology.

The strategy to achieve these goals involves positive action by industry, the FAA, and other Federal, State, and local governments to encourage the expansion of rotorcraft operations both in current applications and in scheduled passenger and cargo markets in the 200-300 nautical mile range. By 2010, vertical lift aircraft could provide as much as 10 percent of intercity passenger operations capacity in the NAS.

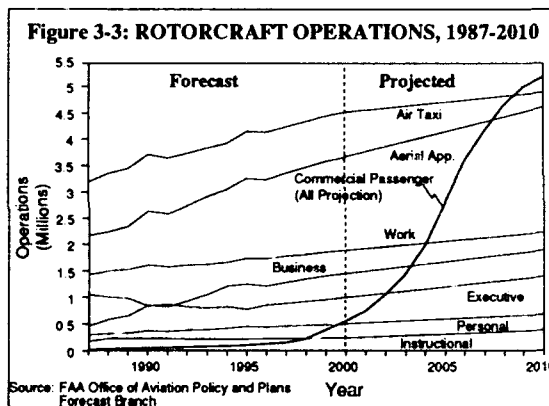
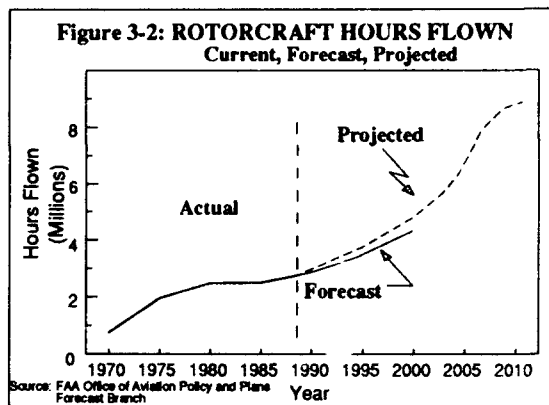
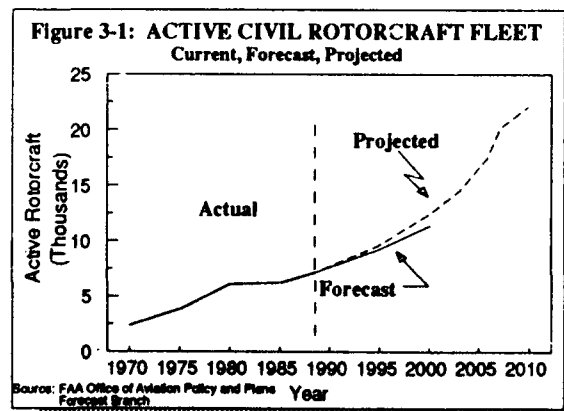
The discussion below is arranged in four categories: applications (the varying missions that vertical lift aircraft perform), infrastructure (public attitudes, heliports and vertiports, routes, and operations), aircraft technology, and pilots.

APPLICATIONS

Total Activity Could Grow Significantly

In 20 years the civil rotorcraft fleet could more than double in size, growing from about 7,000 aircraft today to 20,000 or more, with a proportionate increase in the level of operations, from 10 million operations (2.7M flight hours) today to more than 20 million operations (8.4M flight hours) by the end of the first decade of the next century.

Figures 3-1 through 3-3 present actual data, FAA forecasts, and projections for the active rotorcraft fleet, hours flown, and operations through 2010. The operations data are a projection only. (The forecasts estimate trends based on current types of activity,



while the projections include expected new activities in intercity passenger transportation.)

Scheduled Passenger Services

Perhaps the most significant change in the outlook for the vertical flight industry is the potential for major involvement of vertical lift aircraft in intercity scheduled passenger transportation. This potential arises primarily from two factors: the introduction of tiltrotor technology and increasing congestion expected at airports in major metropolitan areas.

Passenger demand in major metropolitan areas over the next decade is forecast to exceed the capacity of airports. This growth in demand will further aggravate groundside congestion at existing airports.

Part of the solution to this capacity issue could be short haul passenger and cargo service by helicopters and tiltrotor aircraft that operate outside currently congested airspace. Although some markets are served by helicopter today, demand for intercity vertical flight service may grow rapidly as congestion increases, especially following commercial demonstration of the civil tiltrotor in the mid- to latter-1990's. The growth rate of scheduled commuter passenger service could exceed that of all other vertical lift aircraft applications during the first decade of the next century, adding as much as 3 million operations per year to the system without any additional delays.

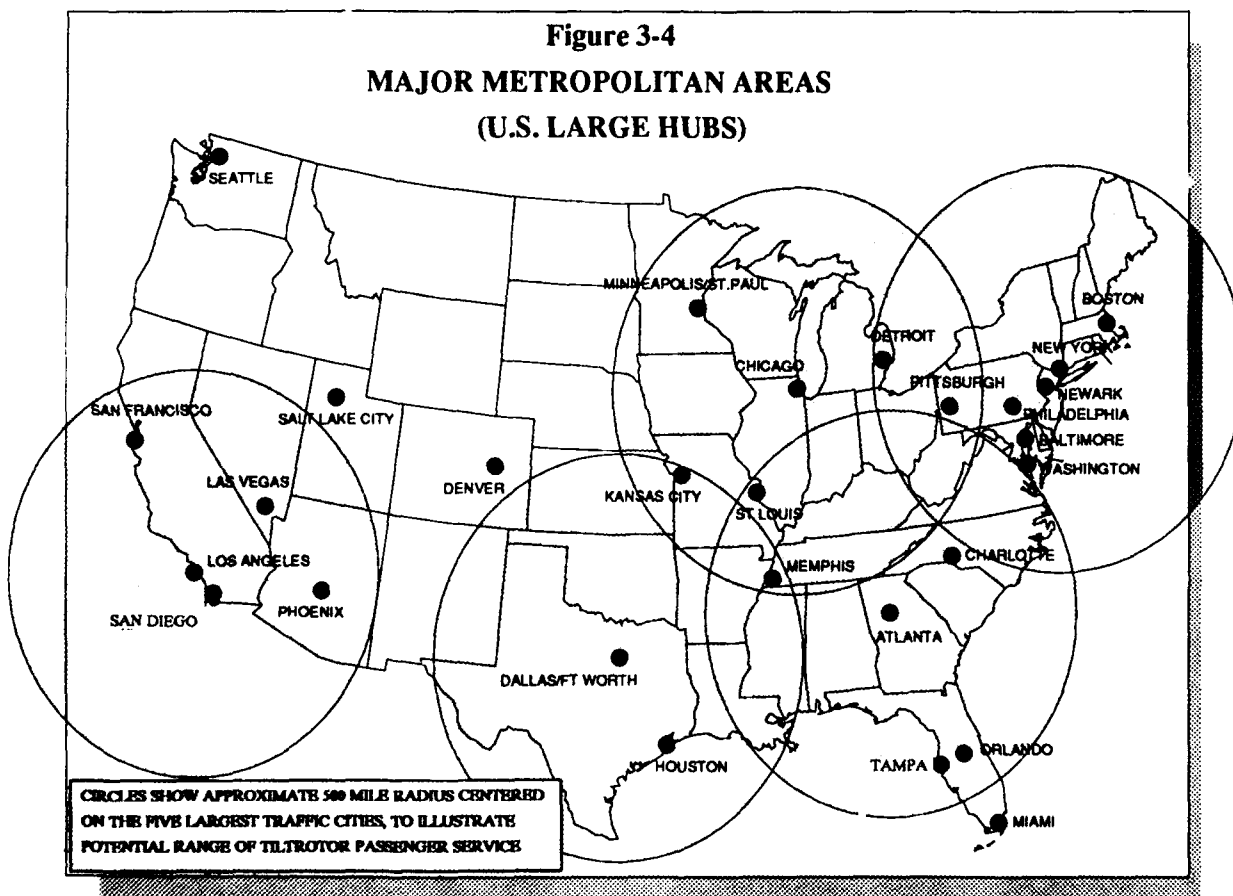
It is likely that major East and West Coast corridors would be the first to see development of intercity passenger service. The most likely cities to serve as hubs and network points for passenger service are the existing large hub airport cities, as shown in Figure 3-4. A 500-nautical mile circle around selected

cities shows the practical range of the tiltrotor aircraft now being developed.

Business-Related Applications

Business use of vertical lift aircraft is forecast to grow substantially over the plan period. Increases in ground congestion could increase the potential for dispersion of corporate facilities within and among metropolitan areas. Coupled with increased availability of public use heliports and all-weather operational reliability, moving people and cargo using vertical lift aircraft could become more attractive, especially relative to ground modes. For the same reasons, executive transport, currently forecast to remain constant through the end of this century, could grow substantially.

The emergency medical service (EMS) industry will continue to grow through the end of this



century and into the next, although with a slower growth rate, and the present trend toward larger and more sophisticated aircraft will continue. EMS helicopters will increasingly operate in all-weather conditions, increasingly operate within controlled airspace, use random routings while receiving full air traffic services, and perform remote site landings and takeoffs using autonomous obstruction avoidance capabilities.

Offshore oil resupply is expected to remain at or near current levels throughout the early 1990's; growth in this activity is tied closely to the real price of oil. Aircraft and other equipment will be upgraded to support all-weather operations and increased flight distances as oil rigs move farther offshore.

Air taxi operations are expected to grow significantly over the next 20 years, both in charter or sightseeing operations and in on-demand service. While the growth in scheduled passenger operations may siphon off some potential demand for air taxis, growth in ground congestion in metropolitan areas will increase demand for alternative modes of transport. On-demand air taxi operations may benefit as a result of new intraurban scheduled passenger service. Evidence of industry interest in such potential markets has already been shown with the first feasibility studies for use of heavy lift vertical flight aircraft.

Aerial observation operations (public safety, traffic watch, and electronic news gathering) as well as aerial application and work related operations (logging, pipeline patrol, and other utility operations) are expected to grow with the industry average.

Personal Use

Growth in personal use of vertical lift aircraft depends on the widespread availability of heliports and simpler landing facilities called helistops. If, as this plan envisions, many new public use heliports are developed, personal use, including personal commuting, can be expected to rise dramatically, especially in the later years approaching 2010.

Training

Training operations, especially those conducted by civilian training facilities, should grow at a pace with the overall growth of the industry. The use of simulators, potentially including the joint use of military simulators by civilian training facilities, will increase and displace some inflight training requirements, especially in proficiency checks.

INFRASTRUCTURE

Heliport/Vertiport Networks; Common Air Traffic Services Support All-Weather Operations

If efforts to enhance recognition and understanding of the unique characteristics of vertical lift aircraft are successful, and if the aircraft are seen as an important element of the national transportation system, development of heliport facilities could be expanded. It is feasible to expect that 500 or more public use vertical lift aircraft landing facilities will be developed over the next 20 years, with about 40 percent of those becoming fully IFR qualified.

Major metropolitan areas—especially in the most congested intercity commuter markets—need comprehensive heliport and vertiport networks, located to provide the maximum potential increase in air transportation system capacity. Networks of intraurban facilities should provide both on-demand and scheduled intraurban service, while feeding passengers and cargo to intercity networks with origins and destinations within 200-300 nautical miles. Civil tiltrotors, operating to and from vertiports, can play a significant role in establishing and providing service in these markets.

Full service heliports and vertiports will be supported by networks of smaller helistops, vertistops, and heliports, conveniently located in central business districts, outlying industrial/commercial sites, suburban areas, and on the land side of terminals at commercial air carrier airports. To maximize its economic potential, each network should be planned, funded, and developed as a unit. This approach will also ensure environmental compatibility, meet user requirements, and allow effective resource management. Environmental concerns, particularly noise, must be addressed through technology (source reduction initiatives by manufacturers) and by adoption of appropriate noise abatement procedures.

Design criteria will be developed for heliport and vertiport design, construction, and operation. The criteria will take efficiency, safety, and passenger amenities into account and will include adequate space and capability for the full range of vertical lift aircraft types. Full service vertiports required by the civil tiltrotor will be somewhat larger and more elaborate than the average full service heliport with fuel, maintenance, storage, training, communications,

weather, and flight planning facilities, as well as pilot lounges. They will also have full baggage and high priority freight handling facilities, ticket counters, jetways, car parking and car rental, and other expected passenger amenities. These features, similar to those found at most major airport terminals today, will be required to successfully operate intercity passenger service with tiltrotors or other vertical lift aircraft.

While many--if not most--operations could be conducted via random routings, VFR and IFR routes would link individual intraurban landing facilities and interurban heliport/vertiport networks as directly as possible while assuring maximum safety and minimal noise exposure. Routes will avoid noise-sensitive areas, using natural and manmade corridors where ambient noise levels are already high, or are expected to become high. The routes would be designated with higher minimum en route altitudes, but would still be in airspace not generally used by fixed-wing traffic. The civil tiltrotor, which may require unique route designations, could operate in airspace above helicopters yet below most fixed-wing en route traffic.

Operations on these routes, as well as on random routings, will require ground and satellite based facilities to receive the weather data and to provide the communication, navigation, and surveillance services for all weather operations.

Terminal area and other air traffic control procedures and services will be required to minimize en route or approach/departure delays experienced by vertical lift aircraft, especially for scheduled or demand air taxis. Where traffic warrants, air taxis will receive expeditious handling and be provided separation service. The civil tiltrotor may require unique air traffic handling procedures in congested airspace to take advantage of its high angle climbout and descent and hovering capabilities. Simulators may be the initial source of operational data to support development of Terminal Instrument Procedures (TERPS). Development of these procedures is a critical milestone in allowing vertical lift aircraft to take full advantage of their operational flexibility.

AIRCRAFT

Civil Tiltrotor Development; FAA Focus on Parallel Development of Regulations and Procedures

The event of greatest potential impact in aircraft technology will be probable deployment of civil

tiltrotors. These aircraft will fly two to three times faster, farther, and higher than current helicopters. They could be introduced into the fleet by major air carriers, their subsidiary regional airlines, or by airlines with code-sharing agreements with the major airlines. Corporate flight departments may find tiltrotors attractive replacements for their short and medium haul aircraft.

Less dramatic, but equally important to passenger service market development, will be the introduction of advanced helicopters that are faster, quieter, and larger than today's. These aircraft would serve intracity and very short distance intercity traffic on both a scheduled and an on-demand basis. Conventionally configured helicopters will have increased speed but will still be slower than tiltrotors.

The major performance advance for rotorcraft will be in one engine inoperative (OEI) capability. Excess power and/or additional engines would be used to assure OEI safety in response to urban heliport and vertiport requirements and commercial air carrier rotorcraft certification criteria. Advances in this area in particular will allow significant reductions in the total land area required for heliports and vertiports, ultimately increasing the potential for development of downtown facilities.

The FAA will encourage and streamline technology certification, both as a way of removing burdens from manufacturers and to spur further developments in performance and safety. Specific certification criteria development will include improved crashworthiness standards; a deicing capability for true all weather operating ability; and improved avionics and flight control systems to provide access to increased CNS coverage. By combining the random routing operational capability of these systems with onboard thermal and radar imaging systems and digital maps, an instrument-based obstruction avoidance capability could ultimately become available. This feature will allow access to unprepared remote sites, even in bad weather.

PILOTS

Demand for Civil Pilots Could Exceed Supply; Advanced Training Technology Commonplace

The pilot population may become a limiting factor to civil vertical flight operations within the next 20 years. It is expected that the number of civil helicopters in the

fleet will increase significantly over this period, as will equipment sophistication. An instrument rating could become a practical necessity for any commercial pilot. As the demand and the equipment sophistication increase; however, military training, which is the best source of civilian pilots today, will no longer be supplying as many pilots. Civilian facilities for initial and recurrent pilot training will be challenged to meet the resulting demand for more and better trained pilots. Advanced simulator technology providing recurrent training and joint use of military simulators, especially those in military reserve units, can help civilian facilities meet this challenge successfully.

Ground school training may need to be enhanced and standardized through computer-based instruction. The typical training syllabus may be expanded to emphasize situational awareness, accident prevention, and attitude development (e.g., aeronautical decision making and "Fly Neighborly" training), in addition to traditional subjects. Training and certification requirements for specific mission types, such as EMS, police activities and drug interdiction, aerial application, and for tiltrotor aircraft may become standardized and form the basis for specialized endorsements to rotorcraft airman licenses.

Chapter 4

CRITICAL ISSUES

Overall Challenge

Challenges to the vertical flight industry fall within several areas, here called critical issues. Achieving the goals of the RMP will require successful completion of projects that address each of them.

The RMP review identified ten critical issues contained within the following five areas:

- o improved public perceptions (including public image and environment),
- o a network of public use IFR heliports and vertiports (including heliports/vertiports, low-altitude routes, and NAS integration),
- o expedited procedures and regulations to advance safety (including safety, advanced technology, and Government/industry communications),
- o more comprehensive statistical information on vertical flight operations, and
- o improvements in pilot and controller training.

The ten issues highlight the gaps that must be filled to achieve the goal detailed in Chapter 3. Once these concerns are addressed, rotorcraft operations will be extended to IFR weather conditions. All weather operational capabilities will generate not only private profits but considerable public benefits in the areas of capacity enhancement, passenger service, EMS, and other applications.

The five issue areas are described in more detail below.

Public Perceptions

One reason that helicopters have not expanded into the air carrier market is that they have a negative public image. They are seen as available only to the elite,

and as noisy intrusions on the peacefulness of the home. This perception is a significant factor in delaying or denying the development of heliports in most areas, and perhaps in limiting the number of people who initially would use vertical flight passenger service.

Improved public perceptions of rotorcraft and their environmental impacts were the first priorities identified during the review. Two issues were formulated:

Public Image (Issue 1). If rotorcraft are to expand into the air carrier market and provide relief to the capacity problem in major metropolitan areas, the public must come to accept and appreciate the benefits of rotorcraft and rotorcraft operations, especially their potential for enhancing airspace capacity.

Environmental (Issue 2). Environmental impacts, especially noise, must be addressed both technologically and operationally to minimize community annoyance.

Heliport/Vertiport Networks

The small number of existing public use heliports acts as a barrier to more rapid development of the vertical flight industry. The review identified the lack of an integrated heliport network and associated infrastructure as the second highest priority. The review group noted, however, that the heliports themselves were only a part of the overall problem. This issue area also includes route structures to link the heliports, weather sensing capability, and integration of operations into the NAS.

Heliport/Vertiport Networks (Issue 3). If rotorcraft are to expand into the air carrier market and meet their potential for executive transport, air taxi, and charter operations, a network of strategically located public use heliports and vertiports must be established.

NAS Integration--All Weather Operation (Issue 4). Low altitude en route and heliport weather requirements must be addressed if rotorcraft are to reduce weather-related accidents and make further advances in instrument operating capability.

NAS Integration--ATC (Issue 5). Additional air traffic services must be provided to support point-to-point operational capability. The ATC system must adjust to improvements in rotorcraft operational performance and avionics capabilities.

These issues link directly to the need to establish networks of heliports. Vertical lift aircraft need 1) heliports in economically profitable locations; 2) an efficient, designated route structure between the heliports; and 3) air traffic services that take into account the aircraft's unique operating capabilities. NAS communications, navigation, and surveillance capabilities must be expanded to cover the vertical flight operating environment in all weather conditions. Such expansion will benefit all types of applications.

Safety

Progress in regulations and procedures has not kept pace with the rate of technological advancement. The time between development of new technology and its introduction into the NAS must be reduced. Furthermore, the benefits of vertical flight transport must be communicated effectively to State and local governments as well as to the public at large. Advances in vertical lift aircraft technology--in avionics, performance, IFR capability, payload, range, and the ability to fly in icing conditions--will be required to allow the desired expansion of the industry. The RMP Review grouped these three issues as the third highest priority.

Safety (Issue 6). The FAA and industry must continue to work together to establish, keep current, and uniformly apply requirements and standards. Strong safety programs ensure compliance. Emphasis should be placed on educational materials and programs, training requirements, safe operating procedures, and judgment training. Operators, in their own interest, should participate in and encourage the development of those programs.

Advanced Technology (Issue 7). The degree of rotorcraft sophistication and advancing rotorcraft technology should be commensurate with the level of performance demanded by the mission. As the requirements of rotorcraft missions increase, so should FAA regulations and procedures development. In addition, FAA participation in international arenas must keep pace with the technological advances, innovative rotorcraft uses, and industry marketing needs.

Government/Industry Communications (Issue 8). Enhanced Government and industry communication is essential to addressing any issue facing advancement of rotorcraft.

The three safety issues are interwoven. Safety is paramount in all aviation, but particularly so in improving the image of vertical lift aircraft as they

expand into commercial passenger service. New technology promises to increase safety and allow these aircraft to be used in more demanding missions. Communications among industry and state, local, and Federal Government agencies must continue and improve as a prerequisite to addressing these issues.

Operating Statistics

The industry and the FAA need more complete statistical data on the size of the active fleet and its operations. Most helicopter operations occur at private, uncontrolled heliports or helipads, and helicopters do not always appear in traffic counts at towers or approach control facilities. As a result, official FAA data submissions may understate the level of helicopter traffic. Current safety statistics may be overly conservative if accident rates are based on fewer operations than actually occur. The lack of firm, credible statistical data on the number and types of helicopter operations may be creating an inaccurate safety image--both on the part of the public at large and on the part of governments at all levels.

The lack of credible statistics hampers all aspects of industry development. Forecasts of future operations form the basis for qualification for FAA grants to local agencies. Undercounting operations leads directly to underfunding of needed infrastructure improvements. This issue was viewed as a fourth priority.

The entire vertical flight community--industry, the FAA, NASA, the National Transportation Safety Board (NTSB), and DOD--needs to develop and implement a valid and consistent method for gathering and sharing vertical flight statistical data.

Operating Statistics (Issue 9). Improved collection and analysis of operational statistics will significantly improve the prospects for addressing all issues of concern to the rotorcraft industry. In addition, it will assure a proper balance of resources between funds committed to rotorcraft system improvements and those committed to fixed-wing system improvements--to the extent that the two differ.

Training

If advances in vertical lift aircraft technology and improved infrastructure lead to expanded markets for these aircraft, the demand for well-trained pilots will grow. The introduction of new technology and new operations such as commercial passenger service will

increase the number of pilots to be trained. These developments will also increase the amount of initial and recurrent training that pilots will need in order to become certified in and fly the new generation aircraft. Maintenance and operations personnel will require training to ensure safety and to keep up with the technology. The review established this as a fifth priority.

Training (Issue 10). Training programs and requirements must be established and updated for controllers, operators, and operations and maintenance personnel. These programs must respond to operational and operating environment changes and safety considerations.

Proper training programs and requirements are essential to addressing several of the issues already described. IFR operations, commercial passenger service, and new technology cannot be introduced without them. New training requirements must be developed parallel to certification standards and operational procedures. Both pilots and controllers will need training in vertical flight IFR operations to integrate them properly into the NAS. Increasingly sophisticated training programs will be required to accommodate the new technology and to help increase the rate at which civilian pilots and operations and maintenance personnel can be introduced into the system.

Resolving the Issues

The overall strategy is for FAA to take all necessary steps to ensure that industry and other public agencies--Federal, State, and local--have the opportunity to take maximum advantage of the economic potential of vertical lift aircraft to serve existing and new markets, especially scheduled passenger service. Sub-strategies consistent with this overall approach were developed for the three goal areas described in Chapter 3: infrastructure, aircraft technology, and pilots. Table 4-1 shows the coverage of the ten critical issues in these three goal areas.

Table 4-1 SUB-STRATEGIES RELATED TO ISSUES			
	Infra- structure	Aircraft	Pilots
PUBLIC PERCEPTIONS			
1. Public Image:	•		
2. Environmental:	•	•	•
HELIPORT/VERTIPORT NETWORKS			
3. Heliport/Vertiport Networks:	•		
4. NAS Integration--Route:	•		
5. NAS Integration--ATC:	•		
SAFETY			
6. Safety:		•	•
7. Advanced Technology:		•	•
8. Government/Industry Communications:	•	•	•
OPERATING STATISTICS			
9. Operating Statistics:	•	•	
TRAINING			
10. Training:			•

Chapter 5

INFRASTRUCTURE

The FAA plans to encourage 1) the development of vertical lift aircraft landing facilities and navigational capabilities, and 2) the initiation of scheduled intercity passenger service. Developing networks of landing facilities will enhance both existing helicopter mission performance and generate public dialogue on objections to helicopters and heliports (safety issues, environmental impact, local siting issues). Initiation of scheduled passenger service by vertical lift aircraft will enhance NAS capacity and indirectly benefit all other vertical flight applications through the additional landing facilities developed to meet passenger demand.

Four strategies, with associated key milestones, will be used to implement these two aspects of infrastructure expansion:

o **Enhance public image by stressing the economic benefits of helicopter and tiltrotor operations:**

- I-1) In 1990 establish a rotorcraft focal point within the FAA to facilitate various rotorcraft related activities
- I-2) Support industry efforts to develop in 1990 an overall public relations approach to enhance rotorcraft's public image
- I-3) In 1990 establish and maintain data systems to depict accurately rotorcraft safety levels

o **Encourage local, State, and regional authorities, as well as private industry, to take the lead in heliport and vertiport development and construction:**

- I-4) Begin a commercial demonstration of civil tiltrotor service by mid-1994, including identifying sites and an operator and making needed improvements to landing facilities

- I-5) By 1994 promote and encourage development of metropolitan heliport/vertiport system studies covering all congested terminal areas

o **Provide Federal financial support for facilities:**

- I-6) By 1998 promote construction of public use heliports/vertiports in metropolitan areas with congested airspace (as a subset of this effort, by 1991, identify key metropolitan areas for focused efforts to develop heliport networks and, by 1993, place one or more networks in operation)

- I-7) Promote construction of at least

- a total of 100 public use heliports and vertiports by the year 2000,
- a total of 250 public use heliports and vertiports by 2005,
- a total of 500 public use heliports and vertiports by 2010,

ensuring that 40 percent of the above public use heliports and vertiports are fully IFR capable by 2010.

o **Provide needed navigation capabilities:**

- I-8) - By 1992 complete development of helicopter TERPS criteria (also needed to support a civil tiltrotor demonstration);
- By 1993 designate routes and develop the necessary random routing navigating capability to support then existing public use heliport networks and a civil tiltrotor demonstration;
- By 1994 provide helicopter route charts for major metropolitan areas, especially those identified in I-6; and
- By 1995 develop the CNS capabilities needed to support scheduled, all-weather operations by vertical lift technology aircraft in major short haul passenger markets.

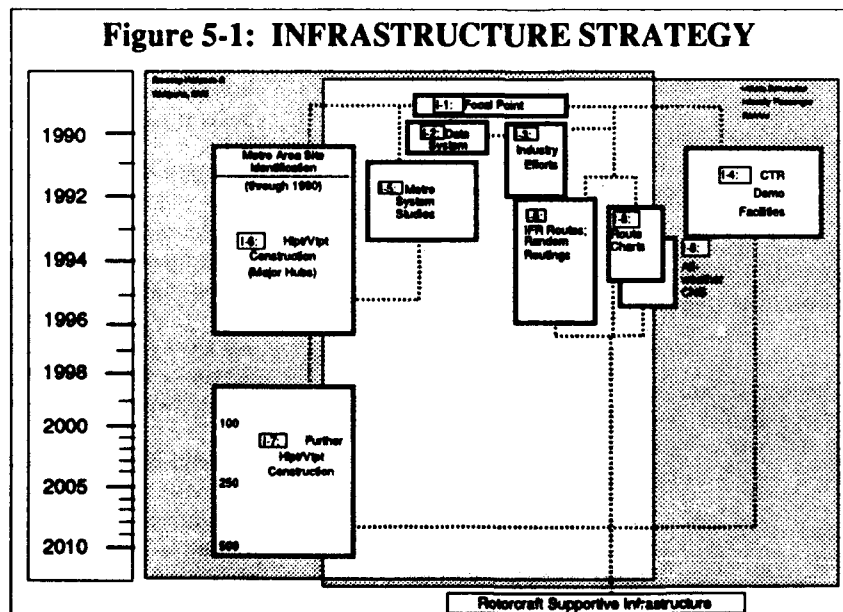
A key element in implementing these strategies is enhancing existing FAA/Government/industry communications by establishing a rotorcraft focal point (I-1). The task of this focal point will be to coordinate activities, including allocating the burdens of implementation efficiently and equitably among governments and industry. Figure 5-1 depicts the relationships among these key milestones in achieving the two overall infrastructure objectives.

Establishing the rotorcraft focal point will facilitate initiation of system studies which, in turn, will support other efforts encouraging heliport and vertiport development. The focal point will also facilitate work to expedite introduction of civil tiltrotor aircraft and complete work on CNS requirements, including terminal instrument procedures (TERPS). Completion of TERPS (I-8), which includes matching aircraft performance to landing facility ground area requirements, is critical to making heliport and vertiport designs compatible with downtown landing area space limitations. TERPS are also a prerequisite to developing full IFR capability, IFR routes and random routing capabilities, and to identifying weather data requirements. These capabilities in turn lead to

improved operating economies by expanding both the geographic range of operations and the weather conditions in which they can occur.

These efforts, in tandem with joint industry/Government efforts to improve the public image of the vertical flight industry, will result in an environment in which service by vertical lift technology aircraft will become economically attractive to communities, encouraging them to construct and operate heliports and vertiports. Figure 5-2, at the end of this chapter, relates these key milestones to the infrastructure component of the RMP goals, the associated critical issues, and the activities needed to implement the strategy. On the far left of the figure is a segment of the infrastructure vision defined in Chapter 3, Goals. Aligned with it are the critical issue(s) most closely related to it (the aspect of that critical issue needing resolution), the relevant strategy, and projects to implement the strategy.

Implementing the heliport and vertiport network vision requires activities that will support design criteria development and site selection, and that will encourage heliport and vertiport development,



including capital funding of actual facilities.

Projects in previous versions of the Rotorcraft Master Plan have primarily supported design criteria development. In this version of the RMP, the initiatives address more advanced milestones associated with heliport and vertiport network development. These include identifying appropriate heliport and vertiport sites in metropolitan areas with congested terminal airspace, exploring the possibility of a funding set-aside within the Airport Improvement Program, actively encouraging state and regional programs to promote heliport development, and promoting development of specific heliports or vertiports at particularly important sites.

Infrastructure projects must also incorporate public relations efforts to bolster and improve the public image of the industry. One aspect of such efforts would be improved data gathering operations to depict vertical flight safety more accurately--and more confidently. Creating an interconnecting network of routes and routing capabilities will require a series of interrelated projects including ongoing TERPS work; identification of low-level CNS requirements and facilities needed for VFR and IFR operations; identification of weather data requirements and sensor needs to support all-weather operations; capital funding requirements of needed facilities, if any; and development of design criteria for heliports and vertiports to ensure environmental compatibility.

FIGURE 5-2
ROTORCRAFT MASTER PLAN:
INFRASTRUCTURE MASTER DETAIL
(Public image of rotorcraft, Heliport/vertiport networks,
Helicopter routes, and Environmental concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Government-Industry communications will have evolved through a period of formal institutional arrangements, which focus on expedited infrastructure development, to a status in which rotorcraft issues are treated in the same way as other aviation segments' issues	o <u>Government-Industry Communications:</u> Need to enhance communications arrangements to support and promote heliport/vertiport development	I-1: Establish in 1990 a focal point within FAA to continue and enhance formal Industry/ Government communications supporting Rotorcraft Master Plan development and implementation.	API-90-005-I: Rotorcraft Focal Point Evaluation, 3/90 [complete] Rotorcraft Task Force: FAA and industry sponsored forum for regular exchanges of information between Government and industry. Helicopter Hotline ^{1/} : Electronic bulletin board for information exchange among rotorcraft interests. Rotorcraft Roundtable ^{2/} : Annual meeting of rotorcraft interests to discuss pressing industry issues.
o Public image of rotorcraft will have improved significantly, allowing some improvement in ability to site and construct heliports/vertiports	o <u>Public Image</u> Need to improve safety image in order to lower barriers to heliport development	I-2: Support industry efforts to develop in 1990 a public relations program, including promotional events, to enhance rotorcraft public image	Helicopter Appreciation Day ^{2/} : Annual fly-in of helicopters, open to the public to encourage public education and support for rotorcraft. General Aviation Market Expansion (GAME) Plan ^{2/} : Industry-sponsored public relations program with specific rotorcraft component.

^{1/}Developed and administered by the Helicopter Association International (HAI)

^{2/}Conducted during the HAI Annual Meeting

^{3/}Joint effort among several general aviation trade organizations

FIGURE 5-2
ROTORCRAFT MASTER PLAN:
INFRASTRUCTURE MASTER DETAIL
(Public image of rotorcraft, Heliport/vertiport networks,
Helicopter routes, and Environmental concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Public image of rotorcraft will have improved significantly (cont.)	o <u>Operations Statistics:</u> Need for statistical data to accurately depict rotorcraft safety levels	<u>I-3:</u> Establish in 1990 and maintain data systems to accurately depict rotorcraft safety levels	API-89-003-I: Rotorcraft Data System, 8/90 [complete] Safety Through Accurate Technical Statistics (STATS) ^{1/} : Ongoing Industry program to provide complete and accurate statistics on the civil helicopter fleet.
o Interurban heliport and vertiport networks will link major urban areas; these full service heliports and vertiports will be supported by a network of smaller IFR and VFR helistops and heliports in central business districts, commercial/industrial parks, suburbs, and at airport terminals	o <u>Heliports/Vertiports Networks:</u> Need for infrastructure to allow growth of operations in all rotorcraft applications	<u>I-4:</u> Begin a commercial validation of civil tiltrotor service by mid-1994, including identifying sites and an operator and making needed improvements to landing facilities	ARD-90-001-I: Tiltrotor Demonstration Implementation, 6/93 API-91-007-I: Update Heliport Noise Model for Tiltrotor, 12/93 API-91-008-I: Update Part 150 Program for Tiltrotor, 12/93 API-91-009-I: Revise FAA Order 1050.1D, 12/92
		<u>I-5:</u> Promote development of metropolitan heliport system studies covering all congested terminal areas by 1994	ARP-82-014-I: Advisory Services to Aviation and City Planners, 3/91 ARP-87-021-I: Heliport Research and Development, [ongoing] ARD-82-080-I: Heliport/Vertiport Design and Planning, 6/93 [for current tasks to be completed] API-92-010-I: Helicopter Passenger Service Study, 6/93

^{1/} Developed and administered by the Helicopter Association International (HAI).

FIGURE 5-2
ROTORCRAFT MASTER PLAN:
INFRASTRUCTURE MASTER DETAIL
(Public image of rotorcraft, Heliport/vertiport networks,
Helicopter routes, and Environmental concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Interurban heliport and vertiport networks (cont.)	o <u>Heliports/Vertiports Networks (cont.)</u> : Need for infrastructure to allow growth of operations in all rotorcraft applications	I-6: - Promote development of heliports/vertiports in all congested terminal areas by 1998	ARP-89-001-I: Heliport/Vertiport Development, [completion date indefinite (near term promotional materials development, 12/90)] API-90-002-I: Aviation Trust Fund Set-Aside Evaluation, 1/91
		I-7: - Promote development of at least: - a total of 100 hipts/vtpts by 2000; - a total of 250 hipts/vtpts by 2005; - a total of 500 hipts/vtpts by 2010, with 40 percent fully IFR qualified.	ARP-89-002-I: Statewide Heliport Planning, [completion date indefinite; work in progress] ARP-89-003-I: Vertiport Design Guide, [completion date indefinite; draft complete, 12/89]

FIGURE 5-2
ROTORCRAFT MASTER PLAN:
INFRASTRUCTURE DETAIL
(Public image of rotorcraft, Heliport/vertiport networks,
Helicopter routes, and Environmental concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
<ul style="list-style-type: none"> o VFR and IFR routes will link intraurban and interurban heliports/vertiports; air traffic services will be available to allow rotorcraft to maximize use of random routings; IFR capability; hover and low speed (IFR zero-zero), high angle approach and departure capabilities 	<ul style="list-style-type: none"> o Air Traffic Services: Need for random routing and full IFR operational capability to allow reliable, scheduled service between heliports/ vertiports 	<p>I-8:</p> <ul style="list-style-type: none"> - Provide: - helicopter TERPS promulgated by 1992 - necessary routing capability for a civil tiltrotor demonstration in 1993. - helicopter route charts by 1994 for major metropolitan areas (see Strategy I-5, pg. 5-5); and, - enhanced rotorcraft routing information, and an all-weather en route operational capability (technology, routings) for rotorcraft to serve major passenger markets by 1995 	<p>TERPS-related:</p> <p>AVR-82-023-I: TERPS Chap. 11 Co-Located MLS, 9/91</p> <p>AVR-87-029-I: Rotorcraft Performance in the Visual Segment, 7/93</p> <p>AVR-84-230-I: Rotorcraft IFR Approach Minimums, [open]</p> <p>AVR-85-203-I: Rotorcraft IMC Fully-Coupled Approach/Minimum Equipment Criteria, 9/90</p> <p>ARD-89-011-I: Rotorcraft IFR Operations Evaluation, 12/95 [for current projects]</p> <p>Air Traffic-related:</p> <p>ATP-89-001-I: Air Traffic Plans and Management, 3/90 [Complete]</p> <p>ATP-89-002-I: Charting and Route Structures, 1/94 [charts to support near-term heliport networks complete by 7/92]</p> <p>ARD-82-020-I: Rotorcraft ATC Development, 9/97 [for current projects]</p> <p>ATP-89-003-I: Transition Routes and Procedures, 12/94 [activities to support near-term heliport networks and civil tiltrotor complete by 1/93]</p> <p>ATP-89-004-I: Terminal Area Procedures, open [activities to support near-term heliport networks and civil tiltrotor complete by 1/93]</p> <p>ATP-89-005-I: Controller Training, open [activities for near-term heliport networks and civil tiltrotor complete by 1/93]</p>

FIGURE 5-2
ROTORCRAFT MASTER PLAN:
INFRASTRUCTURE DETAIL
(Public image of rotorcraft, Helicopter/vertiport networks,
Helicopter routes, and Environmental concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
<ul style="list-style-type: none"> o Communications, navigation, and surveillance (CNS) data will be supplied in sufficient quantity and of sufficient quality to ensure reliable service -- comparable to that of then current fixed wing passenger service 	<ul style="list-style-type: none"> o <u>Air Traffic Services:</u> Need for all-weather operations capability at typical rotorcraft operating altitudes; IFR procedures; positive control; especially, terminal environment 	<p>(Same as I-8 above) Provide necessary NAS terminal and en route operational capability</p>	<p>CNS-related: ARD-82-040-I: Low Altitude Communication, Navigation, and Surveillance, 5/91</p>
<ul style="list-style-type: none"> o Weather data will be supplied in sufficient quantity and of sufficient quality to ensure reliable service comparable to that of then current fixed wing passenger service 	<ul style="list-style-type: none"> o <u>Weather:</u> Need for all-weather operations capability at typical rotorcraft operating altitudes; IFR procedures; positive control; especially, terminal environment 	<p>(Same as I-8 above) Provide necessary NAS terminal and en route operational capability</p>	<p>Weather-related: [Weather-related aspects of air traffic and CNS projects identified above, in particular ATP-89-004-I, above, under "Air-Traffic related:"]</p>
<ul style="list-style-type: none"> o Routes will maximize use of existing noise corridors and will be located as high as possible to minimize en route noise 	<ul style="list-style-type: none"> o <u>Environment:</u> Need to reduce helicopter noise and rotorcraft en route noise to lower barriers to development 	<p>(Same as I-8 above) Provide necessary NAS terminal and en route operational capability</p>	<p>[Environmental aspects of air traffic projects identified above.]</p>

Chapter 6

AIRCRAFT TECHNOLOGY

The FAA will expedite development of a range of rotorcraft technology and standards. The objective is to ensure the operational readiness of advanced vertical lift technology as the NAS requires it--and the system infrastructure becomes ready to accept it--and to encourage technological advances as a spur to infrastructure development. The strategy also calls for pursuit of common international certification standards.

The pursuit of advanced technology and the development of certification criteria to advance the safety of technology and the overall airspace system are cornerstones of FAA's mission. The FAA works now and will continue to work with NASA, DOD, and international organizations to identify safety-enhancing technologies. In addition, there is constant communication with industry--operators and manufacturers--to identify the most promising, evolving technologies for safety enhancement and to develop appropriate standards and certification criteria.

In addition to the FAA, NASA, DOD, and other Federal agencies, manufacturers and operators should develop advanced technologies to support existing applications and markets and to exploit potential new markets. Those initiatives are essential to the ultimate success of this plan.

Figure 6-1 depicts in detail the relationship of aircraft technology strategies to the vision of the future, the associated critical issues, and the activities needed to implement the strategy. Even though much of the work--as defined in strategy elements T-1 through T-3--is ongoing, the accelerated development of scheduled passenger service by vertical lift technology aircraft envisioned in this plan warrants highlighting two major milestones:

- o By 1994 certificate a military V-22 tiltrotor for use in a demonstration (element T-4)
- o By 1997 certificate a V-22 civil derivative tiltrotor for passenger operations (element T-5)

Attainment of these milestones is critical if the civil tiltrotor demonstration program is to be initiated as planned by 1994. Initial certification criteria have been developed and efforts continue to complete certification of a military V-22 Osprey configured for civil use.

Ongoing efforts to improve vertical lift technology include improved deicing technology, crashworthiness, Terminal Collision Avoidance Systems, fly-by-wire criteria, and reduced minimum speed IFR capability, which in turn would support decelerating precision approaches.

Other efforts, in addition to those identified as major milestones, may include conferences or symposia to showcase promising new safety-enhancing technologies. Current civil tiltrotor-related efforts include engine and fuselage design optimization, and noise and vibration research. Other joint efforts are needed involving the FAA, industry, NASA, and DOD.

Renewed efforts to encourage adoption of common international certification criteria for rotorcraft technology are also needed, including evaluation of full FAA membership on the International Civil Aviation Organization's (ICAO) Helioops Panel.

**FIGURE 6-1. ROTORCRAFT MASTER PLAN:
AIRCRAFT TECHNOLOGY DETAIL**

(Aircraft certification,
International certification standards, and
Advanced rotorcraft technology concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o FAA will identify promising, safety enhancing technologies	<ul style="list-style-type: none"> o Advanced Technology/Operations Statistics: Need to identify promising technologies for developmental focus/emphasis 	<p>I-1: - Identify safety-related technologies having the greatest potential for enhancing overall rotorcraft industry safety, considering the anticipated growth of scheduled passenger services and the share of total operations by other rotorcraft applications</p>	<p>ARD-82-100-T: Rotorcraft Icing, 12/93</p> <p>ARD-85-130-T: Rotorcraft Atmospheric Electrical Hazards, 12/89 [complete]</p> <p>ARD-89-005-T: Rotorcraft Display and Control Studies, 12/92 [for current projects]</p> <p>ARD-89-090-T: Rotorcraft Airworthiness and Flying Qualities, 12/91</p> <p>ARD-82-110-T: Rotorcraft Crashworthiness/Structural Airworthiness, 9/89 [complete]</p> <p>API-90-001-T: Safety Technology Research Grants, 6/91</p> <p>ASW-89-001-T: Technology Alternatives for Category "A" One Engine Inoperative Performance, 1/93</p> <p>ASW-89-002-T: Health and Usage Monitoring Systems, 1/93</p> <p>Engine Trend Monitoring System^{1/}: Evaluation of available health and usage monitoring systems.</p>

^{1/} Conducted by the Helicopter Association International (HAI) technical committees.

**FIGURE 6-1. ROTORCRAFT MASTER PLAN:
AIRCRAFT TECHNOLOGY DETAIL**

(Aircraft certification,
International certification standards, and
Advanced rotorcraft technology concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o FAA will continue to develop certification criteria at a pace with technology development wherever possible	o <u>Advanced Technology:</u> Need for certification criteria development to keep pace with technology development so as to speed the introduction of new, safer technology	I-2: - Develop and implement action plans for technology R&D support and encouragement, and certification criteria development, so as to coincide with the timing of other elements of this plan, especially heliport development	ARD-82-090-T: Rotorcraft Airworthiness and Flying Qualities, 12/91 ARD-89-006-T: Rotorcraft Obstruction Avoidance, 12/92 for current projects ASO-89-001-T: Helicopter Simulator Qualification Standards, 12/99 ASW-82-013-T: Transport Cat. Rctt Structural Fatigue and Damage, 9/89 [complete] ASW-84-111-T: Turbine Burst Protection for Trans. Cat. Rotorcraft, 12/90 ASW-85-113-T: Crash Resistant Fuel Systems, 10/91 ASW-84-011-T: Occupant Restraint in Normal/Transport Category Aircraft, 1/93 ASW-82-021-T: Advanced Electronic Helicopter Standards, 2/94 ASW-83-016-T: Transport Category Rotorcraft Performance, 7/91 ASW-82-115-T: Rotorcraft Regulatory Review Program Notice No. 4 [Airframe], 10/89 [complete] AVR-82-030-T: Regulatory Activities--Operations, 3/90 [Complete] AVR-85-202-T: Rotorcraft Advanced Flight Control/Display, 12/99 AVR-85-203-T: Rotorcraft IMC Fully-Coupled Approach/Minimum Equipment Criteria, 9/90

**FIGURE 6-1. ROTORCRAFT MASTER PLAN:
AIRCRAFT TECHNOLOGY DETAIL**

(Aircraft certification,
International certification standards, and
Advanced rotorcraft technology concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
<ul style="list-style-type: none"> Noise abatement technology will reduce noise levels sufficiently to allow significant increases in rotorcraft operations and still reduce community noise exposure to acceptable levels 	<ul style="list-style-type: none"> Environment: Need for quieter helicopter operations to reduce barriers to heliport/vertiport network development 	<p>Same as I-2:</p> <ul style="list-style-type: none"> Develop and implement plans for advanced technology. 	<p>API-89-006-T: Noise Certification Standards for Tiltrotor, 1/94 Rotorcraft Focal Point: Vertical Lift Aircraft Noise Abatement Technology Transfer Assessment, 12/90</p>
<ul style="list-style-type: none"> Helicopters will continue to operate at speeds close to those of today but will have enhanced capabilities, including one engine inoperative (OEI) hover; research and development efforts will cover the technologies needed for these capabilities 	<ul style="list-style-type: none"> Advanced Technology: Need for OEI hover capability and certification so as to support various rotorcraft missions, especially passenger operations into and out of small landing areas 	<p>Same as I-2:</p>	<p>ASW-83-018-T: Revised One-Engine Inoperative (OEI) Power Rating, 12/90</p>
<ul style="list-style-type: none"> FAA will continue to support development and seek adoption of common international certification standards 	<ul style="list-style-type: none"> Safety: Need for international standardization to encourage U.S. technology development 	<p>I-3:</p> <ul style="list-style-type: none"> Pursue common international certification standards 	<p>ASW-83-017-M: Common Rotorcraft Certification Requirements Coordination, 7/89 [complete]</p>

**FIGURE 6-1. ROTORCRAFT MASTER PLAN:
AIRCRAFT TECHNOLOGY DETAIL**

(Aircraft certification,
International certification standards, and
Advanced rotorcraft technology concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Commercial validation of civil tiltrotor aircraft will take place in the early 1990's	o <u>Advanced Technology:</u> Need for early certification of V-22 tiltrotor to support demonstration	<u>I-4:</u> - Certify V-22 for civil use to support initiation of demonstration of civil tiltrotor service by 1994	Joint Government-Industry Memorandums: DOD V-22 Full Scale Development Program Data Inputs to Civil Certification, 12/93 ASW-89-003-T: Civil Tiltrotor Certification, 12/93 [dependent on military program timing]
o Civil tiltrotor will be certified and will serve various needs, including expanded intercity passenger operations	o <u>Advanced Technology:</u> Need for high speed, highly maneuverable, high comfort, lower noise technology aircraft to expand intercity passenger markets open to vertical lift aircraft	<u>I-5:</u> - Certify civil tiltrotor for operation by mid-1997	ARD-89-002-T: Technical Support for Expedited Certification of a Civil Tiltrotor, 12/96 ARD-89-003-T: Improved Tiltrotor Technology, 6/94
o Government/industry communications will continue to work as they do now: vertical lift technology issues will be treated in the same way as other aviation issues	o <u>Government/Industry Communications:</u> Expedite certification criteria development process; maximize efficiency of early technology examination	Same as I-1: - Continue and enhance formal Government-Industry communications supporting Rotorcraft Master Plan development and implementation.	ASW-83-020-T: Rotorcraft Certification Guidance, 5/89 [complete] See also projects under I-1

Chapter 7

PILOTS

Maintaining an adequate level of training to meet mission requirements and supplying enough trained pilots and mechanics to satisfy the demands of vertical lift aircraft missions has been and continues to be a private sector function. FAA will continue to develop the training requirements, simulator standards, and educational materials and programs needed to support this function.

As noted in Chapter 3, however, civilian training facilities may be hard pressed to meet the demand for fully IFR qualified vertical lift aircraft pilots and the mechanics needed to service aircraft. This shortage is being felt now and is anticipated to grow into the first decade of the next century. Aggressive efforts to enhance airspace capacity by increasing use of vertical lift aircraft could exacerbate the gap between the supply of and the demand for pilots and mechanics. FAA will monitor this situation and act to support industry efforts to close the gap if necessary.

Figure 7-1 shows the relationships among the pilot-related vision of the future, the associated critical issues, and the activities needed to implement the strategy. In addition to ongoing activities (strategy elements P1 and P2), Figure 7-1 includes two key milestones in overall RMP implementation:

- o By mid-1992 develop and certificate civil tiltrotor pilot and mechanic training programs (element P3)
- o Prepare by 1994, and maintain thereafter, an action plan, including resource requirements and a schedule of tasks, for ensuring an adequate supply of mechanics and fully qualified civilian pilots to provide scheduled passenger service by vertical lift aircraft (element P4)

FAA will emphasize development and certification of training programs that encompass the full range of skills needed for IFR flight. In addition, training materials and programs will be improved.

Increases in the number of rotorcraft operations may result in increased noise, both in heliport/vertiport environs and en route. Training programs will take this potential into account and will incorporate noise abatement procedures as mandatory requirements. Industry has already acted in this area with its "Fly Neighborly" program, and further work should build on that effort.

High fidelity simulators offer significant potential for increasing safety and for substituting simulator time for inflight training. Efforts are needed to expedite development of such simulators for vertical lift aircraft and to certificate them.

FIGURE 7-1. ROTORCRAFT MASTER PLAN: PILOTS DETAIL

(Pilot/Mechanic availability and performance,
Training programs, and
Simulator usage concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Educational materials and programs provide a source of continuing information to increase pilot awareness of new procedures, programs, regulations, and safe operating practices	o <u>Rotorcraft Safety/ Government-Industry Communications:</u> Need to improve pilot awareness through safety and education programs and materials	P-1: Support development of safety and education programs and materials directed toward safer rotorcraft operation.	AVR-89-001-P: Rotorcraft Safety Program, 9/91 Hull and Liability Insurance Program ¹⁷ : Industry program to encourage safety through pilot training and aircraft maintenance inspections. Maintenance Malfunction Information Report (MMIR) ¹⁷ : Industry program to encourage reporting of maintenance defects/service difficulties.
o Instrument ratings typically will be required for commercial pilots; this may result in increases in required pilot training	o <u>Training:</u> Need for more sophisticated training curriculum to cover commercial pilot requirements, including IFR operations	P-2: Develop and certificate advanced rotorcraft pilot training programs, covering both IFR capability and new procedures that will expedite rotorcraft operations; implement these programs consistent with introduction of advanced rotorcraft, especially tiltrotor.	AVR-82-090-P: Rotorcraft Airman Certification, 10/91 ARD-85-150-P: Rotorcraft Voice Technology, [indefinite]

¹⁷ Developed and administered by the Helicopter Association International (HAI)

**FIGURE 7-1. ROTORCRAFT MASTER PLAN:
PILOTS DETAIL**

(Pilot/Mechanic availability and performance,
Training programs, and
Simulator usage concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
o Training will include as a requirement that noise abatement procedures be learned and applied in all noise sensitive operational applications	o <u>Environment:</u> Need for all opportunities for noise abatement to be implemented as far as possible, including operating procedures training	Same as P-2.	Fly Neighborhood ^{1/2} : Ongoing industry program to encourage widespread use of noise abatement procedures.
o Special ratings may be required for commercial tiltrotor pilots	o <u>Training:</u> Need for more sophisticated training curriculum to cover commercial pilot requirements, including IFR operations	P-3: Develop and certificate by 1992, civil tiltrotor pilot training programs.	ARD-90-001-I: Tiltrotor Demonstration Implementation, 6/93 (also in Chapter 5, Infrastructure, Figure 5-2, under Strategy I-4, pg. 5-5.) (See projects related to strategy P-2, Pilot Training Programs)
o Civilian training facilities will meet the challenge of greater demand for rotorcraft pilots	o <u>Training:</u> Need to ensure a qualified supply of civilian pilots to meet rotorcraft requirements	P-4: In conjunction with industry, prepare by 1994, and maintain thereafter, an action plan for supporting industry efforts to ensure an adequate supply of mechanics and fully qualified civilian pilots.	API-91-004-P: Rotorcraft Pilot Review, 6/92

^{1/2}Developed and administered by the Helicopter Association International (HAI)

FIGURE 7-1. ROTORCRAFT MASTER PLAN: PILOTS DETAIL

(Pilot/Mechanic availability and performance,
Training programs, and
Simulator usage concerns)

<u>GOAL ELEMENT</u>	<u>ISSUE AREA/NEED</u>	<u>STRATEGY</u>	<u>PROJECTS</u>
<ul style="list-style-type: none"> Advanced simulators and other flight training technology will offset the need for additional training facilities to some degree and increase the safety of pilot training, including a reconfiguration capability, which will allow training to suit specific, and unique, mission requirements; simulators will increasingly be used for recurrent training, and notably, for flight examinations 	<ul style="list-style-type: none"> Advanced Technology: Need for more sophisticated simulators to support training in advanced rotorcraft technologies and procedures, to augment existing training capacity, and to increase safety in training programs 	<p>Same as I-8: Provide:</p> <ul style="list-style-type: none"> necessary routing capability for a civil tiltrotor demonstration in 1993, helicopter route charts by 1994 for major metropolitan areas (see Strategy I-5, pg. 5-5), and enhanced rotorcraft routing information, and an all weather enroute operational capability (technology, routings) for rotorcraft to serve major passenger markets by 1995 	<p>AVR-83-051-P: Rotorcraft Simulator Use in Airman Certification, open [started]</p> <p>ARD-85-140-P: Rotorcraft Simulator Standards, 9/95</p>

Developed and administered by the Helicopter Association International (HAI)

Chapter 8

CIVIL TILTROTOR INITIATIVE

In response to a congressional request, FAA announced on June 16, 1988, that it would certificate the military's V-22 Osprey by December 1992, with certification of a pressurized civil tiltrotor by late 1995. A recent program review has resulted in changing these goals to January 1994 and January 1997, respectively. These dates are projected to be at least 5 years ahead of current European tiltrotor development goals. Actions leading to achievement of these goals are referred to as the National Civil Tiltrotor Initiative.

The civil tiltrotor has the potential to enhance significantly the existing capacity of the NAS. The tiltrotor will take off and land vertically as other rotorcraft do, and will transition to and from a fixed-wing, turboprop-like configuration during cruise operations. It will fly at speeds comparable to turboprops over distances of 200-500 nautical miles (nm). Because of these capabilities, the tiltrotor offers the potential of serving commuter markets, downtown to downtown, rather than from outlying airports.

The civil tiltrotor may also act as a catalyst for growth of the vertical lift aircraft industry as a whole. Facilities established for scheduled passenger service by tiltrotors could be used by other vertical lift aircraft. Successful tiltrotor experience could help to establish a new and potentially massive market for all vertical lift aircraft.

Achieving an operational civil tiltrotor system within the next decade will require significant initiatives on the part of the FAA and other Federal agencies, State and local governments, manufacturers, and helicopter owners and operators. These initiatives will require tight coordination in order to meet milestones and overcome the hurdles to development of such a system. Success in this endeavor will also ensure that many needs identified for helicopters will be met, including the development of TERPS, enhanced random routing capability, broader availability of

weather information, and most importantly, development of more public use heliport/vertiport facilities.

FAA originally established a Civil Tiltrotor Project Staff to coordinate FAA activities associated with development of the civil tiltrotor and to work closely with other public and private parties. This staff has recently been aligned with other vertical flight activities with FAA and is now called the Vertical Flight Program Office. A Vertical Flight Program Plan is currently under development and should be published in early 1991. This plan will describe the actions necessary to integrate all vertical flight aircraft types, including tiltrotor, into the National Airspace System operations. The Vertical Flight Program Plan will provide the necessary detail for executing and monitoring the progress of projects cited in the RMP.

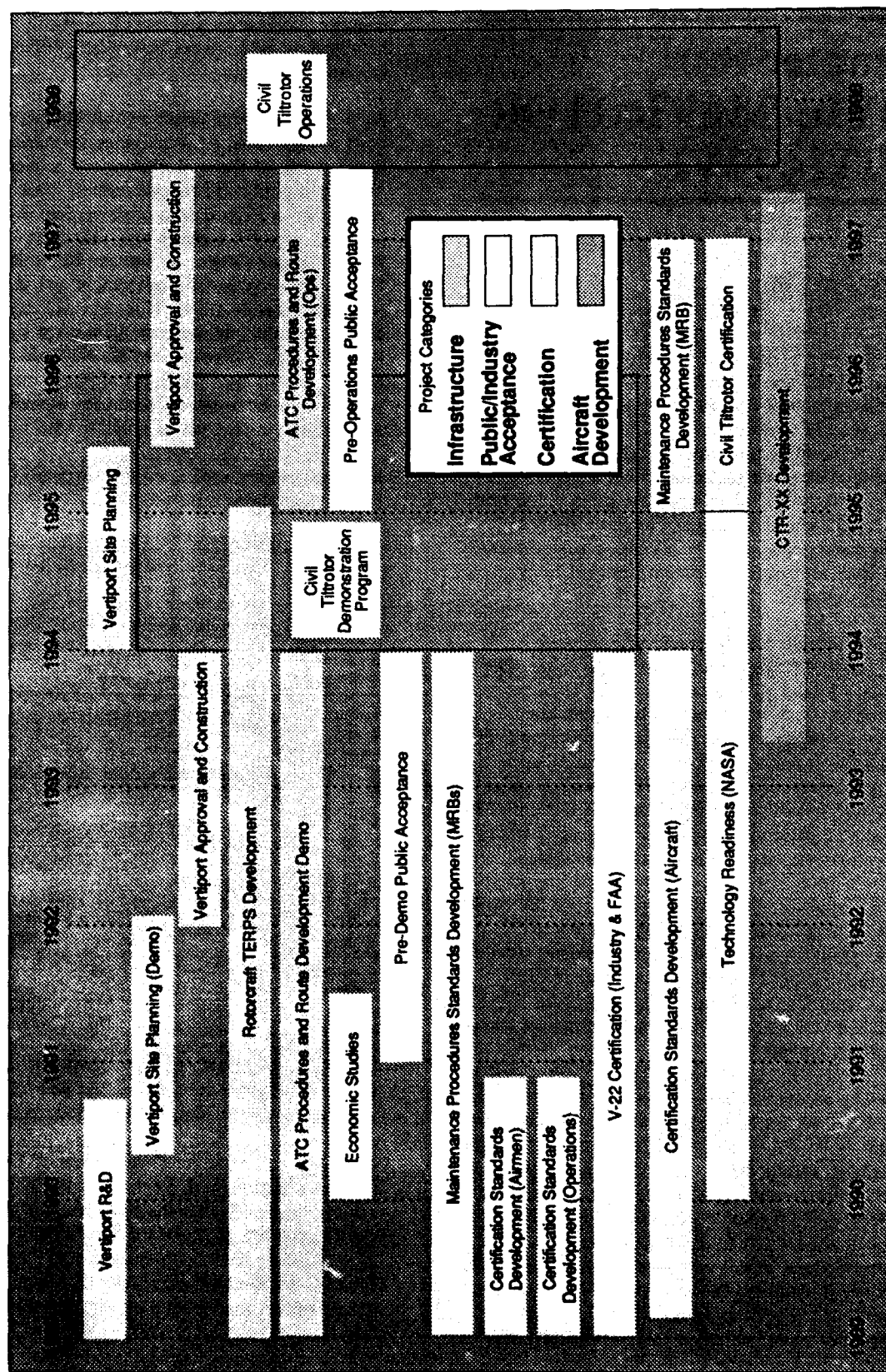
Major milestones associated with expedited civil tiltrotor introduction include:

1988:	-	V-22 Osprey first flight
1991:	-	vertiport planning completed, demonstration sites identified
	-	guidelines for route structure development complete
1994:	-	demonstration route network completed
	-	V-22 certificated
	-	vertiports operational
	-	civil tiltrotor demonstration start
1997:	-	civil design certificated

Figure 8-1 depicts these milestones and other pertinent information on the initiative on a horizontal bar chart.

FAA data collection for development of TERPS and civil certification work on the military V-22 have already begun. This is the first time that civil certification has proceeded in parallel with military system testing and acceptance efforts. Joint FAA/NASA research efforts on the design enhancements for the civil tiltrotor are also underway.

Figure 8-1: CIVIL TILTROTOR INITIATIVES



Source: FAA Vertical Flight Program Office

Vertiport development may be the most difficult barrier to civil tiltrotor intercity passenger service, and the FAA has taken the initiative to expedite studies on this issue. The FAA has also actively encouraged potential tiltrotor users, operators, and public sponsors of vertiport development to focus on the great potential this technology has for time savings and delay reductions in our most heavily travelled air corridors. Federally funded feasibility studies of potential vertiport sites have been undertaken in New York, the District of Columbia, Boston, and other metropolitan areas and regions. FAA is conducting periodic planning seminars with those involved in ongoing vertiport planning studies and with potential sponsors of such studies. These seminars will ensure that planning efforts and data gathering are coordinated and that essential information for later funding decisions is acquired.

The success of the civil tiltrotor effort is linked directly to the continuing full-scale development and production release of the military V-22 program. Loss of military and congressional backing for the V-22 could slow the development and introduction of a civil tiltrotor significantly--as has been indicated above.

Chapter 9

IMPLEMENTATION

Introduction

The Rotorcraft Master Plan goals focus on the potential of rotorcraft in the NAS in 20 years. Achieving this future will require near-term commitments of time, effort, staff, and funding. In addition to the FAA, these commitments will have to be made by other Government agencies and by industry. To justify continuing commitments by any of these organizations, it will be important to show satisfactory progress at critical points along the path to the ultimate checkpoints. This chapter provides an overview of the RMP, focusing on important checkpoints at which to evaluate system performance and to determine:

- o whether major investments in future activities called for in the plan should be made or not, and
- o whether changes in the operating environment warrant altering the basic strategies of the plan.

Phased Accomplishments and Checkpoints

The plan can be divided into four time periods, with a major investment decision needed at the end of each.

Present through 1993: Improve rotorcraft's public image and continue safety enhancements while integrating rotorcraft into the NAS; develop sufficient heliports to establish one or more networks; certificate the V-22 for civil operations; prepare the system for a tiltrotor demonstration; and scheduled helicopter passenger services. In 1993 determine whether resource commitments to increase rotorcraft passenger applications and to fund a civil tiltrotor demonstration are warranted.

1994 through 1996: Add to and improve heliport/vertiport networks and evaluate the success of helicopter passenger services and the civil tiltrotor demonstration. In 1996 determine whether increased resource commitments to widespread development of public use heliport and vertiport networks (a total of 100 public use landing facilities by the year 2000) are warranted.

1997 to 2000 and 2001 to 2005: Continue efforts to expand development and construction of heliports and vertiports, especially those with IFR capability, to meet and encourage demand for vertical lift aircraft services. At the end of each phase, determine whether sufficient demand exists to warrant further Federal financial support and encouragement to meet the landing facility goals of the RMP.

These four phases and the checkpoints associated with them are opportunities to measure how the system is performing relative to the plan's goals. Monitoring and tracking projects will also ensure adequate staffing and funding in a timely manner.

The phases are further described below. The first is presented in the greatest detail to provide guidance to planners and decisionmakers on the short-term thrust of the plan.

Present to 1993

Information gathered during this phase will help determine whether continued and increased FAA commitment to the use of vertical lift technology to enhance NAS capacity is warranted. In particular, the information would be used to determine whether 1) continued or enhanced encouragement of public use heliport development and 2) further funding of civil tiltrotor development is justified. A positive decision would commit the FAA to conduct or support a civil tiltrotor demonstration and to promote public use heliport network development. A decision at this point, however, would not commit the FAA to a formal policy favoring vertical lift aircraft use as a cornerstone of NAS capacity enhancement.

A scenario that would support a go-ahead decision at the 1993 checkpoint would include:

- o Growing scheduled passenger service by helicopters in metropolitan area and short distance intercity markets;
- o A high potential for tiltrotor technology to penetrate 200-300+ nm intercity commuter markets, further improving the economic status of the industry; and
- o An overall upward trend in rotorcraft operations and sales.

Table 9-1 lists the key milestones (M) for this scenario. The left column contains milestones that

Table 9-1: KEY MILESTONES 1990-1993

<u>All Vertical Lift Aircraft</u>	<u>Civil Tiltrotor</u>
1990	
1. Rotorcraft Focal Point	
2. Rotorcraft Public Image Program	
3. Rotorcraft Data Systems in Place	
1991	
4. Heliport Networks Defined (capable of supporting various rotorcraft applications, especially scheduled passenger service; minimum number of networks/facilities necessary for assessing rotorcraft passenger service potential)	6. CTR Demonstration Sites Chosen
5. Rotorcraft Simulator Certification Criteria	7. Route Structure Guidance
1992	
8. Rotorcraft Public Image Improving	10. Funding For Vertiport Development or Improvement
9. Rotorcraft TERPS Complete	12. Civil Tiltrotor Pilot Training Program
11. Initial Helicopter Route Charts	
1993	
13. Heliport Networks Operating	15. Route Network Complete (CTR Demonstration)
14. U.S. Helicopter Sales Grow	17. Operator Chosen for CTR Demonstration
16. Scheduled Helicopter Service	

apply to all rotorcraft; milestones on the right are specific to the civil tiltrotor. Milestones 7 and 15 are shown as specific to civil tiltrotor objectives, but their achievement is applicable to all powered lift aircraft.

Figure 9-1 shows the sequence and interrelationships of all key milestones through the year 2000. These milestones include both FAA responsibilities and areas in which other public agencies and industry must lead.

FAA work in the safety, training, and heliport/vertiport construction areas is continuous and is highlighted in the figure as ongoing processes rather than distinct milestones. Notable exceptions to this are

- o establishing simulation certification criteria (M 5), which will permit greater use of simulators for pilot training; increased safety will result and perhaps a reduction in the in-flight hours needed for licenses and proficiency, and
- o funding and land facility site preparation work for a civil tiltrotor demonstration (M 6 and 10).

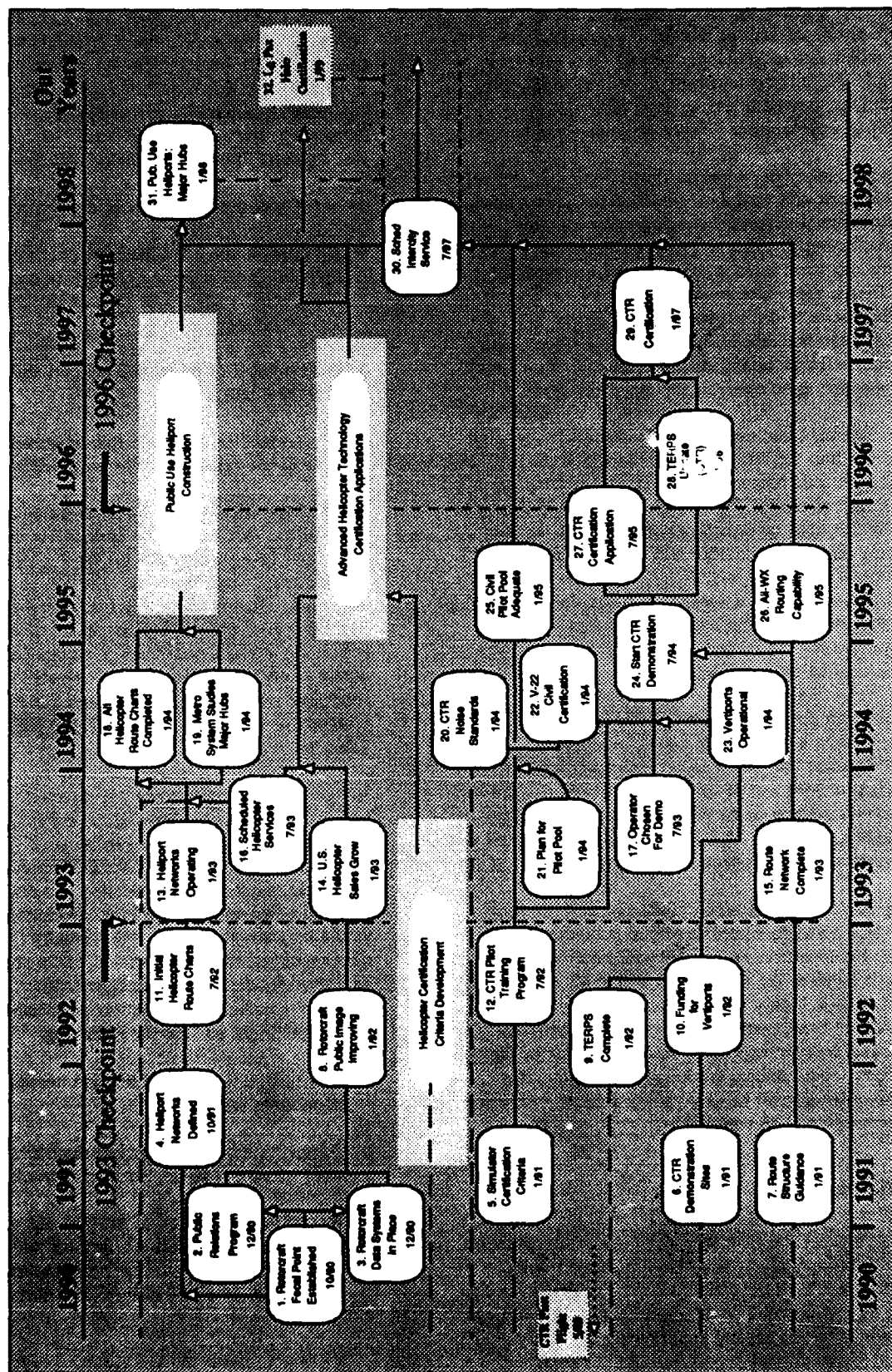
The milestones continuing through 1993 stress improving the public image of rotorcraft to strengthen public support for heliport or vertiport development (M 1, M 2, M 3, M 8, M 14); and developing the

necessary infrastructure for support of expanded rotorcraft passenger services and the civil tiltrotor demonstration (M 1, M 4, M 6-13, M 15, and M 17).

Heliport network development is the joint responsibility of all parties interested in vertical flight development, with prime responsibility lying with potential heliport or vertiport sponsors and aircraft operators (M 4, M 13). The FAA's role is to continue funding and to ensure NAS compatibility with potential scheduled vertical flight operations (M 7, M 9, M 11, M 15). One of the most critical milestones in this area is completion of rotorcraft TERPS development (M 7) so that heliport and vertiport space requirements can be fixed. Without this information, early construction of public use landing facilities will not occur--especially that needed for conduct of a civil tiltrotor demonstration--nor will longer term planning of vertiports in downtown areas be feasible. This milestone is also a precursor to development of preliminary TERPS for civil tiltrotors--criteria that can be validated during the planned 1994 demonstration of that technology.

The FAA will also support local planners and Government decisionmakers both on the technical side of heliport development and in promoting the economic benefits of vertical lift aircraft, especially

Figure 9-1
MAJOR ROTORCRAFT MILESTONES TO 2000



in passenger service (M 1, M 3, M 4, M 11). Achieving these heliport development milestones and generating strong interest in increased use of helicopters for various missions (e.g., successful establishment of helicopter service on one or more public use heliport networks) is critical to making additional commitments to large scale public use heliport development (1996 Checkpoint and beyond).

Because many organizations must participate actively if heliports and vertiports are to be developed quickly in support of expanded passenger services, a coordinating function within FAA is needed. This rotorcraft focal point would monitor progress, identify and close gaps in responsibility for critical action, and bring issues to decisionmakers in a timely fashion. This is the function envisioned in Milestone 1, the rationale for its establishment at an early date, and its connection to so many of the other milestones.

Development and expedited introduction of the civil tiltrotor into the NAS is a task for which the FAA has taken the lead responsibility. The FAA's success in this task, however, depends on the accomplishment of several actions on which others must take the lead: timely aircraft availability and submission of data for the certification process leading to V-22 certification (M 22), industry and vertiport sponsor commitments to undertake landing facilities development or improvement (M 10 and M 23), and operation of a civil tiltrotor demonstration (M 17).

Improving the public image of rotorcraft is a prerequisite to large scale heliport/vertiport development and to improved helicopter sales (M 2 leading to M 8 and M 14). Primary responsibility for activities leading to these improvements lies with industry, while the FAA and other public agencies can provide technical assistance as appropriate.

The FAA considers accomplishment of these first phase milestones a prerequisite to commitments of staff and resources associated with later milestones. While meeting the indicated deadline for each milestone is highly desirable, minor delays will not affect the basic premises of the plan. Significant delays, however, especially in development of the civil tiltrotor, could reduce the long-term potential for vertical lift aircraft to make a significant contribution to enhancing NAS capacity.

1994 to 1996

This phase of the plan focuses on operations, support, and enhancement. It will also determine whether activity levels--during the civil tiltrotor demonstration and on metropolitan area heliport networks--warrant commitments to expand significantly the use of

vertical lift aircraft as a NAS capacity enhancement tool. A positive decision would commit FAA to establish a program office or high level focal point for coordinating heliport/vertiport development (up to a total of 100 public use heliports and vertiports by the year 2000). It would also include a commitment to encourage a substantial percentage of public use heliports to become fully IFR qualified. A scenario that supports these commitments includes:

- o Successful demonstration of the civil tiltrotor;
- o An upward trend in scheduled passenger operations by helicopters, especially in IFR operations, and a trend in sales toward larger capacity passenger service aircraft;
- o Development of additional heliport and vertiport networks; and,
- o A continued or increased rate of growth in overall vertical lift aircraft operations and sales.

Detailed specifications of major milestones is premature at this time. The state of the industry and operations in 1996 depends on the interplay of variables that could drive the situation in opposite directions. This is especially true of current efforts to develop a civil tiltrotor and assess its potential for enhancing intercity commuter passenger capacity within the NAS. Some key provisional milestones--consistent with the plan's goals and the strategies presented in Chapters 5, 6, and 7--are presented in Table 9-2.

Altogether, these milestones are directed toward establishing reliable scheduled intracity and intercity passenger service by vertical lift aircraft. Assuming the 1993 checkpoint milestones are achieved, the substantial additional commitment of resources required to accomplish the 1996 checkpoint milestones would be warranted by the FAA and by the operators, manufacturers, local heliport and vertiport sponsors, and other public and private organizations involved in their implementation. Indicators of success during this timeframe might include the following:

- o First fully IFR qualified heliport network ensuring all-weather service;
- o Competition among rotorcraft operators in one or more scheduled passenger service markets;
- o Successful completion of the civil tiltrotor demonstration and serious operator interest exemplified by manufacturer application for certification of a new design civil tiltrotor; and

Table 9-2: KEY MILESTONES 1994-1996

<u>All Vertical Lift Aircraft</u>	<u>Civil Tiltrotor</u>
1994	
18. All Helicopter Route Charts Completed	20. GTR Noise Standards
19. Metropolitan Systems Studies Completed for all Major Hubs	22. V-22 Civil Certification
21. Plan for Adequate Pilot Pool	23. Vertiports Operational
	24. Start Civil Tiltrotor Demonstration
1995	
25. Civil Pilot Pool Adequate	27. Civil Tiltrotor Certification Application
26. All-weather Routing Capability	
1996	
	28. Civil Tiltrotor TERPS Update
	29. Civil Tiltrotor Certification

- o First vertical lift aircraft certificated with autonomous obstruction avoidance landing capability from a point-in-space approach.

The 1994-1996 milestones and decision criteria will be updated in future editions of the RMP.

1997 Through 2000

This phase will determine whether heliport and vertiport development and associated vertical flight operations, especially passenger operations, warrant continued emphasis and resource support by FAA for vertical lift technology as a NAS capacity enhancement tool. A positive decision would result in continued support as outlined in the 1996 checkpoint, with an overall objective of 100 public use heliports and vertiports by 2000 (M33). Milestones leading to the year 2000 checkpoint, consistent with the RMP goals, are listed in Table 9-3.

The overall indicators of success for this checkpoint are an increase in sponsor applications for Federal aid for heliport and vertiport planning and development, a movement in FAA's RMP workload away from a project orientation toward the programmatic and routine, and continued growth in the demand for scheduled passenger operations by rotorcraft. Specific milestones might include:

- o Certification of a civil tiltrotor aircraft for passenger operations (1997)
- o The beginning of scheduled intercity passenger service by vertical lift aircraft (1997); and

- o Public use heliports/vertiports in all major hub metropolitan areas (1998)

Reaching any of these milestones prior to the 2000 checkpoint would constitute an impressive achievement for vertical flight and mark a significant departure from its current applications in the NAS.

2001 Through 2005

Like the year 2000 checkpoint, the 2005 checkpoint will continue the assessment of whether heliport and vertiport development and associated vertical flight operations warrant continued emphasis and resource support by FAA for vertical lift technology as a NAS capacity enhancement tool. A positive decision would result in continued support as outlined in the 2000 checkpoint, with an overall goal of 250 public use heliports and vertiports by 2005 (M34), and 500 by 2010 (M35). Twenty to forty percent of these would be fully IFR qualified.

The milestones associated with this phase of the plan and the final phase leading to 2010 are taken directly from Chapter 5, Infrastructure, and represent continued availability of Federal funds for heliport and vertiport development.

Summary and Conclusion

Successful implementation of the Rotorcraft Master Plan depends on the joint commitment of Federal, State, and local government agencies and industry. Major commitments by any component depend in turn

Table 9-3: KEY MILESTONES 1997-2000

All Vertical Lift Aircraft

Civil Tiltrotor

1997

30. Scheduled Intercity Passenger Service by Vertical Lift Aircraft

1998

31. Public Use Heliports at all Major Hubs

1999

32. Large Capacity Passenger Rotorcraft

2000

33. 100 Public Use Heliports

on ensuring all are working in concert and with equal commitment. The checkpoints described in this chapter provide the initial basis for ensuring that this common commitment exists at major investment decision points and that the direction of joint efforts is appropriate for each of these parties.

The checkpoints are also a first effort to identify critical decisions on rotorcraft's potential as part of the solution to the NAS capacity shortage. As the plan evolves, these checkpoints and their associated milestones will be validated and revised where necessary, and a more comprehensive and specific set of milestones will be developed.

This FAA Rotorcraft Master Plan has involved an extensive review by FAA and the rotorcraft community of existing rotorcraft projects and has resulted in the identification of a desired vision of the future. Implementation, however, depends on

maintaining and improving the communications and cooperation between industry and Government that have been enhanced during the past year. Industry shares with the FAA and other Government agencies the responsibility for achieving the vision of the future.

This RMP will be used to provide justification to commit resources to high priority rotorcraft projects. It will provide a framework to monitor project implementation, feedback new issues and problems, and report progress to industry. The RMP, however, is not static. Over the longer term, the FAA will monitor the rotorcraft environment, evaluate the plan for consistency, and make changes as appropriate. Continuing the industry and governmental involvement that has shaped this plan is vital to future updates and to ensuring that, where major discontinuities occur, responsive and timely action is taken to meet rotorcraft needs.

APPENDIX: PROJECTS

The projects summarized below are FAA and industry activities that have specific milestones for accomplishment over the next 5 years. Activities that are routine or continuous are not included as projects.

The previous RMP, published in 1987, contained 104 projects. This plan contains 56--30 projects carried over from the 1987 RMP and 26 new projects. Many of the 104 projects in the 1987 RMP have been completed. In addition, many activities listed as projects in 1987 are actually continuous activities of the FAA and, as such, are not listed here.

Heliport/Vertiport Development

Project Number: ARP-89-001-I

Contact: George Bolduc APP-400

Phone#: 202-267-8786 FTS 8-267-8763

DESCRIPTION/OUTPUTS: Initiatives will be undertaken to promote development of heliports and vertiports, especially in urban areas which suffer from serious limitations on conventional aircraft capacity as well as ground congestion. An important element will be development of a professional presentation which could be shown to and used by appropriate State, regional and local governmental bodies.

Start Date: 6/89

Completion Date: (completion date indefinite [near-term promotional materials development, 12/90])

Statewide Heliport Planning

Project Number: ARP-89-002-I

Contact: George Bolduc APP-400

Phone#: 202-267-8786 FTS 8-267-8786

DESCRIPTION/OUTPUTS: Use FAA regional representatives as well as headquarters staff to develop coordinated State and Federal programs to facilitate heliport/vertiport development. Survey state planners to determine current activities and needs. Encourage and assist State planning and promotional activities directed toward location and development of public use heliports and vertiports consistent with RMP objectives. Would also seek to maximize public access to private facilities and develop State and regional facility directories.

Start Date: 6/89

Completion Date: [completion date indefinite; work in progress]

Many of the projects listed here have more detailed project descriptions that include a schedule for each major project milestone. These more detailed project summaries are available from the contact person whose name is listed with each project. These summaries will be used for periodic reviews of the RMP.

Note that numbers for new projects (those starting with 89) are assigned serially. Also, the project numbering system has been changed. Previous RMP documents had a suffix "M" for every project. This system has been replaced with a letter suffix indicating the association of the project with a major segment of the RMP: "I" for infrastructure, "T" for technology, "P" for pilots. The projects are grouped by Office of Primary Interest. The secondary sort is by project number, using the three digits after the year.

AIRPORTS

Vertiport Design Guide

Project Number: ARP-89-003-I

Contact: Jack Burke AAS-100

Phone#: 202-267-8763 FTS 8-267-8763

DESCRIPTION/OUTPUTS: Provide guidance on vertiport design to local planners and governments. The design guide to include information on tiltrotor and other new related technology.

Start Date: 6/88

Completion Date: [completion date indefinite; draft complete, 12/89]

Advisory Services to Aviation and City Planners

Project Number: ARP-82-014-I

Contact: George Bolduc APP-400

Phone#: 202-267-8786 FTS 8-267-8786

DESCRIPTION/OUTPUTS: Provide guidance to local governments, engineers, planners, and the public in support of heliport development. The primary outputs will be additions to advisory circulars for State and Metropolitan Airport System Planning.

Start Date: 12/85

Completion Date: 3/91

Heliport Research and Development

Project Number: ARP-87-021-I

Contact: Jack Burke AAS-100

Phone# 202-267-8763 FTS 8-267-8763

DESCRIPTION/OUTPUTS: Evaluate requested research and development projects being carried out at the FAA Technical Center and implement recommendations as considered appropriate.

Start Date: 1/87

Completion Date: [ongoing]

POLICY AND INTERNATIONAL AVIATION

Safety Technology Research Grants

Project Number: API-90-001-T

Contact: Mike Hartmann APO-120

Phone#: 202-267-3293; FTS 8-267-3293

DESCRIPTION/OUTPUTS: The TRB is supported by FAA, and this Project will seek the establishment of a grant or other special program for creative ideas on safety technology related to vertical flight aircraft.

Start Date: 10/90

Completion Date: 6/91

Aviation Trust Fund Set-Aside

Project Number: API-90-002-I

Contact: Mike Hartmann APO-120

Phone#: 202-267-3293 FTS 8-267-3293

DESCRIPTION/OUTPUTS: The project will determine whether legislation is needed to create a set-aside within the Aviation Trust Fund which would be earmarked for heliport/vertiport development.

Start Date: 10/90

Completion Date: 1/91

Rotorcraft Data System

Project Number: API-89-003-I

Contact: Gene Mercer APO-110

Phone#: 202-267-3355 FTS 8-267-3355

DESCRIPTION/OUTPUTS: Data systems are needed for continuously collecting the data to support statistical analysis of rotorcraft operations. Alternatives will be assessed and a recommendation will be made for an optimal system.

Start Date: 3/89

Completion Date: 8/90 [complete]

Rotorcraft Pilot Review

Project Number: API-91-004-P

Contact: Gene Mercer APO-110

Phone#: 202-267-3355 FTS 8-267-3355

DESCRIPTION/OUTPUTS: Study will be made of the number of pilots with rotorcraft certification, as well as the demand potential for pilots. If a shortage of pilots is seen for the future, identification will be made of the options open to satisfy future needs.

Start Date: 6/91

Completion Date: 6/92

Rotorcraft Focal Point Evaluation

Project Number: API-90-005-I

Contact: Mike Hartmann APO-120

Phone#: 202-267-3293 FTS 8-267-3293

DESCRIPTION/OUTPUTS: The rotorcraft activities of FAA require agency-wide coordination. This project will identify and evaluate options for establishing an agency focal point, and present the analysis to the Executive Board.

Start Date: 1/90

Completion Date: 3/90 [complete]

Noise Certification Standards for Tiltrotor

Project Number: API-89-006-T

Contact: Richard Tedrick AEE-300

Phone#: 202-267-3577 FTS 8-267-3577

DESCRIPTION/OUTPUTS: Develop noise certification standards for tiltrotor aircraft for inclusion as a new subpart to Part 36. Involves engineering and field noise monitoring studies to establish background levels for existing prototype tiltrotor.

Start Date: 5/89

Completion Date: 1/94

Update Heliport Noise Model for Tiltrotor

Project Number: API-91-007-I

Contact: Tom Connor AEE-120

Phone#: 202-267-3570 FTS 8-267-3570

DESCRIPTION/OUTPUTS: Update the existing version of FAA's Heliport Noise Model to include tiltrotor performance and noise data.

Start Date: 1/91

Completion Date: 12/93

Update Part 150 Program for Tiltrotor

Project Number: API-91-008-I

Contact: Bob Hixson AEE-300

Phone#: 202-267-3565 FTS 8-267-3565

DESCRIPTION/OUTPUTS: Amend Part 150, Airport Noise Compatibility Planning Program, to include tiltrotor in the noise/land use compatibility planning process.

Start Date: 1/91

Completion Date: 12/93

POLICY AND INTERNATIONAL AVIATION (cont.)

Revise FAA Order 1050.1D

Project Number: API-91-009-I

Contact: Laurie Fisher AEE-300

Phone#: 202-267-3561 FTS 8-267-3561

DESCRIPTION/OUTPUTS: Revise FAA Order 1050.1D, Policies and Procedures for Considering Environmental Impacts, to include tiltrotor. Revision will require environmental analysis of the performance expected and the route structures anticipated for this aircraft.

Start Date: 1/91

Completion Date: 12/92

Helicopter Passenger Service Study

Project Number: API-92-010-I

Contact: Mike Hartmann APO-120

Phone#: 202-267-3293 FTS

DESCRIPTION/OUTPUTS: Examine the potential market for scheduled helicopter passenger service, considering feasible ranges of future trip seat mile (TSM) costs [costs associated with entire trips--origin to destination rather than air portal to air portal] and helicopter operating distances.

Start Date: 1/92

Completion Date: 6/93

REGULATION AND CERTIFICATION

Rotorcraft Safety Program

Project Number: AVR-89-001-P

Contact: William Wallace AFS-250

Phone#: 202-267-3771 FTS 8-267-3771

DESCRIPTION/OUTPUTS: Develop educational program and materials specific to rotorcraft to support existing FAA aviation safety programs. Specific programs will cover EMS, Gulf and Alaskan operations. Coverage will stress human factors, cockpit resource management, and research to enhance safety in helicopter operations.

Start Date: 6/89

Completion Date: 9/91

Rotorcraft Performance in the Visual Segment

Project Number: AVR-87-029-I

Contact: Robert Clenney AVN-540

Phone#: 405-686-4164 FTS 8-747-4164

DESCRIPTION/OUTPUTS: To assess the viability of allowing rotorcraft to employ see-and-avoid in the visual portion of an instrument approach. To qualify and quantify any see-and-avoid capability realized for application to selected TERPS protective surfaces.

Start Date: 10/87

Completion Date: 7/93

TERPS Chapter 11 Collocated MLS

Project Number: AVR-82-023-I

Contact: Robert Clenney AVN-540

Phone#: 405-686-4164 FTS 8-747-4164

DESCRIPTION/OUTPUTS: Design helicopter standard instrument approach procedures (SIAPS) for collocated MLS based on current helicopter TERPS and other MLS TERPS.

Start Date: Started

Completion Date: 9/91

Regulatory Activities--Operations

Project Number: AVR-82-030-T

Contact: Dave Catey AFS-240

Phone#: 202-267-8094 FTS 8-267-8094

DESCRIPTION/OUTPUTS: Regulatory action to simplify rotorcraft regulation. Actions include deletion of FAR 127 and Section 121.13. A new Part 119 will cover certification of all commercial operations.

Start Date: 6/85

Completion Date: 3/90 [Complete]

REGULATION AND CERTIFICATION (cont.)

Rotorcraft Simulator Use in Airman Certification

Project Number: AVR-83-051-P

Contact: Edna French AFS-850

Phone#: 202-267-8150 FTS 8-267-8150

DESCRIPTION/OUTPUTS: Publish appropriate material in Appendix to Part 61 to incorporate material on helicopter simulators.

Start Date: Started

Completion Date: Open

Rotorcraft Airman Certification

Project Number: AVR-82-090-P

Contact: Wally Emory AVN-130

Phone#: 405-686-4151 FTS 8-747-4151

DESCRIPTION/OUTPUTS: Update airman certification material and techniques. Updating Advisory Circular 61-13B, Basic Helicopter Handbook, and AC 61-27C, Instrument Flying Handbook.

Start Date: 12/82

Completion Date: 10/91

Rotorcraft Advanced Flight Control/Display

Project Number: AVR-85-202-T

Contact: Jim Honaker ASW-111

Phone#: 817-624-5109 FTS 8-734-5109

DESCRIPTION/OUTPUTS: Develop criteria and guidance material for airworthiness certification of rotorcraft advanced flight control and display systems.

Start Date: 6/85

Completion Date: 12/99

Rotorcraft IMC Fully-Coupled Approach/Minimum Equipment Criteria

Project Number: AVR-85-203-I

Contact: Jim Honaker ASW-111

Phone#: 813-624-5109 FTS 8-734-5109

DESCRIPTION/OUTPUTS: Develop criteria and guidance material for airworthiness certification of rotorcraft IMC fully coupled approaches and the associated minimum equipment.

Start Date: Started

Completion Date: 9/90

Rotorcraft IFR Approach Minimums

Project Number: AVR-84-230-I

Contact: Jerry Davis AFS-400

Phone#: 202-267-8452 FTS 8-267-8452

DESCRIPTION/OUTPUTS: Develop airworthiness and operational approval criteria to permit rotorcraft to operate to reduced IFR approach minimums, and to permit rotorcraft to operate to IFR approach to hover and takeoff in airport and heliport environments.

Start Date: 11/84

Completion Date: Open

Helicopter Simulator Qualification Standards

Project Number: ASO-89-001-P

Contact: Edward Boothe ASO-205

Phone#: 404-763-7773 FTS 8-246-7773

DESCRIPTION/OUTPUTS: Develop and publish advisory circular material for qualification standards for helicopter simulators.

Start Date: 6/85

Completion Date: 12/99

AIR TRAFFIC

Air Traffic Plans and Management

Project Number: ATP-89-001-I

Contact: Bud Morgan ATP-120

Phone#: 202-267-9335 FTS 8-267-9335

DESCRIPTION/OUTPUTS: Develop an Air Traffic Planning annex to the RMP that establishes the near-, mid-, and long-term air traffic requirements, responsibilities, and tasks necessary to achieve full rotorcraft integration into the NAS. Also, acquire operational rotorcraft traffic count information to permit a more reliable depiction of rotorcraft safety levels and facilitate decisions pertinent to other project requirements.

Start Date: 5/89

Completion Date: 3/90 [Complete]

Charting and Route Structures

Project Number: ATP-89-002-I

Contact: Bud Morgan ATP-120

Phone#: 202-267-9335 FTS 8-267-9335

DESCRIPTION/OUTPUTS: Expand existing helicopter route chart coverage to all high density rotorcraft traffic areas to enhance rotorcraft operations within those areas during both visual and instrument meteorological conditions. Also, conduct appropriate CNS studies and research to enhance en route operations and facilitate commercial schedule reliability.

Start Date: 5/89

Completion Date: 1/94 (charts to support early heliport networks by 7/92.)

AIR TRAFFIC (cont.)

Transition Routes and Procedures

Project Number: ATP-89-003-I

Contact: Bud Morgan ATP-120

Phone#: 202-267-9335 FTS 8-267-9335

DESCRIPTION/OUTPUTS: Identify and implement transition route requirements to enhance all-weather rotorcraft access to and egress from designated ground operations areas; also develop appropriate air traffic control procedures to facilitate their use. Conduct a limited concept demonstration, if necessary, to establish and evaluate potential operating parameters.

Start Date: 3/90

Completion Date: 12/94 (activities to support near-term heliport networks and civil tiltrotor complete by 1/93)

Controller Training

Project Number: ATP-89-005-I

Contact: Bud Morgan ATP-120

Phone#: 202-267-9335 FTS 8-267-9335

DESCRIPTION/OUTPUTS: Establish national-level criteria for the development and implementation of initial and recurrent rotorcraft familiarization training for air traffic controllers and facility supervisors to increase awareness and knowledge of rotorcraft operating capabilities, and permit enhanced safety and traffic flow efficiency.

Start Date: 3/90

Completion Date: Open (activities for near-term heliport networks and civil tiltrotor complete by 1/93)

Terminal Area Procedures

Project Number: ATP-89-004-I

Contact: Bud Morgan ATP-120

Phone#: 202-267-9335 FTS 8-267-9335

DESCRIPTION/OUTPUTS: Determine the effectiveness of existing ATC procedures for current and future rotorcraft operations within terminal areas. Conduct appropriate procedural validations, modifications, replacements, or initiations, as required, to optimize safety and operational efficiency.

Start Date: 3/90

Completion Date: Open (activities supporting civil tiltrotor demonstration complete by 1/93)

ROTORCRAFT CERTIFICATION DIRECTORATE

Technology Alternatives for Category "A" One Engine Inoperative Performance

Project Number: ASW-89-001-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8-734-5110

DESCRIPTION/OUTPUTS: Investigate the feasibility of achieving transport category One Engine Inoperative hover capability with a variety of technologies now available or becoming so. Issues will include operations, cost, weight, complexity, and power tradeoffs. Feasible concepts would proceed to rulemaking.

Start Date: 2/89

Completion Date: 1/93

Health and Usage Monitoring Systems

Project Number: ASW-89-002-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8-734-5110

DESCRIPTION/OUTPUTS: Investigate potential for Health and Usage Monitoring Systems (HUMS) to improve reliability of drivetrain components. Address issues such as system sophistication versus certification credit. Explore the relationship between HUMS data and issues such as safe life, overhaul times, and failure warning and Projection. Joint program with NASA.

Start Date: 6/90

Completion Date: 1/93

ROTORCRAFT CERTIFICATION DIRECTORATE

Civil Tiltrotor Certification

Project Number: ASW-89-003-T

Contact: James Erickson ASW-100

Phone#: 817-624-5100 FTS 8-734-5100

DESCRIPTION/OUTPUTS: Ongoing effort to provide civil certification to military V-22 tiltrotor. Data from military test programs available to FAA under provisions of an FAA/DOD Memorandum of Agreement.

Start Date: 7/88

Completion Date: 12/93 (Dependent on military program.)

Occupant Restraint in Normal and Transport Category Aircraft

Project Number: ASW-84-011-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8-734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to establish occupant protection standards at a level consistent with the present state-of-the-art.

Start Date: 1/83

Completion Date: 1/93

Transport Category Rotorcraft Structural Fatigue and Damage

Project Number: ASW-82-013-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to add a requirement that damage tolerance criteria be used unless shown to be impractical. The intent is to obtain consistent use of state-of-the-art damage tolerant materials and design features in transport category helicopters.

Start Date: 1/83

Completion Date: 9/89 [complete]

Transport Category Rotorcraft Performance

Project Number: ASW-83-016-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to revise and clarify transport rotorcraft performance airworthiness standards and to establish minimum gradients of climb during takeoff.

Start Date: 6/83

Completion Date: 7/91

Common Rotorcraft Certification Requirements Coordination

Project Number: ASW-83-017-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to allow FAR 27 and 29 to become acceptable codes for type certification of rotorcraft by all AASC authorities, thus relieving the possible need for JAR 27 and 29.

Start Date: 4/87

Completion Date: 7/89 [complete]

Revised One Engine Inoperative Power Rating

Project Number: ASW-83-018-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Amendment to revise Parts 27, 29, and 33 to set forth qualification and performance associated with optional 30-second/2 minute One Engine Inoperative ratings for helicopters.

Start Date: 9/84

Completion Date: 12/90

Rotorcraft Certification Guidance

Project Number: ASW-83-020-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Provide Advisory Circular guidance material on acceptable methods of compliance with FAR 27 and 29.

Start Date: 5/83

Completion Date: 5/89 [complete]

Advanced Electronic Helicopter Standards

Project Number: ASW-82-021-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Provide Advisory Circular guidance material whereby rapidly advancing electronic and electromechanical actuator technology can be incorporated into new rotorcraft.

Start Date: 1/83

Completion Date: 2/94

ROTORCRAFT CERTIFICATION DIRECTORATE

Turbine Burst Protection for Transport Category Rotorcraft

Project Number: ASW-84-111-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to provide an increased level of safety in transport helicopters for the event of uncontained turbine engine rotor burst.

Start Date: 6/89

Completion Date: 12/90

Rotorcraft Regulatory Review Program Notice No.4 (Airframe)

Project Number: ASW-82-115-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory Amendment to revise FAR Parts 27 and 29 to incorporate a number of proposals to update airframe and related equipment requirements, with applicability specific to rotorcraft.

Start Date: 7/82

Completion Date: 10/89 [complete]

Crash Resistant Fuel Systems

Project Number: ASW-85-113-T

Contact: John Shapley ASW-110

Phone#: 817-624-5110 FTS 8 734-5110

DESCRIPTION/OUTPUTS: Regulatory amendment to revise FAR Parts 27 and 29 to require crash resistant fuel system components in rotorcraft.

Start Date: 12/88

Completion Date: 10/91

RESEARCH AND DEVELOPMENT

Tiltrotor Demonstration Implementation

Project Number: ARD-90-001-I

Contact: Jim McDaniel ARD-30

Phone#: 202-267-9870 FTS 8-267-9870

DESCRIPTION/OUTPUTS: Implementation of a civil tiltrotor demonstration program, including selection of route system, development of needed facilities, and determination of an operator.

Start Date: 1/90

Completion Date: 6/94

Improved Tiltrotor Technology

Project Number: ARD-89-003-T

Contact: Jim McDaniel ARD-30

Phone#: 202-267-9870 FTS 8-267-9870

DESCRIPTION/OUTPUTS: With NASA, develop new technology for incorporation into the tiltrotor, particularly those developments which improve economic performance of tiltrotor operations.

Start Date: 6/89

Completion Date: 6/94

Technical Support for Expedited Certification of a Civil Tiltrotor

Project Number: ARD-89-002-T

Contact: Jim McDaniel ARD-30

Phone#: 202-267-9870 FTS 8-267-9870

DESCRIPTION/OUTPUTS: Technical support for certification of a pressurized civil tiltrotor, which is a follow-on to the civil derivative of the V-22.

Start Date: 12/94

Completion Date: 12/96

Rotorcraft Airworthiness and Flying Qualities

Project Number: ARD-89-090-T

Contact: Joseph Traybar ACD-220

Phone#: 609-484-4286 FTS 8-482-4286

DESCRIPTION/OUTPUTS: test using variable stability helicopter and analyze data for handling qualities, controller and display issues for instrument approaches to heliports. Guidance material will be recommended for regulatory development required for certification process.

Start Date: 5/87

Completion Date: 12/91

RESEARCH AND DEVELOPMENT (cont.)

Rotorcraft IFR Operations Evaluation

Project Number: ARD-89-011-I

Contact: Steve Fisher ARD-30

Phone#: 202-267-8535 FTS 8-267-8535

DESCRIPTION/OUTPUTS: Support the development of operating procedures, technology, and systems which will increase the utility of rotorcraft under IMC conditions, IFR operations, and minimal VMC conditions. Provide TERPS Development Procedures educational course. Develop definitions and data to support the Civil Tiltrotor (CTR) Demonstration Program. Provide preliminary CTR flight profile data in determining TERPS standards reflecting CTR flight characteristics. Establish guidelines for structuring training development in risk management, cockpit resource management, and aeronautical decision making. Support the implementation process of incorporating current and projected human factors based rotorcraft flight control, navigation, and health, usage, and monitoring systems (HUMS).

Start Date: Spring 1989

Completion Date: Current projects will be ongoing through 1995.

Rotorcraft Display and Control Studies

Project Number: ARD-89-005-T

Contact: Dean Resch ARD-30

Phone#: 202-267-8514 FTS 8-267-8514

DESCRIPTION/OUTPUTS: Establish current state-of-the-art for electronic display concepts, systems, hardware, symbology, graphics, abstract imaging, and prior conducted electronic display experiments and analyses. Determine the principal electronic display requirements for "Zero\Zero Helicopter Certification Issues", evaluate the effectiveness of various display and graphic techniques by IMC rotorcraft simulator techniques, and provide final report and recommendations for the introduction of these candidate systems.

Start Date: 3/89

Completion Date: Current work carries through 12/92.

Rotorcraft Obstruction Avoidance

Project Number: ARD-89-006-T

Contact: Steve Fisher ARD-30

Phone#: 202-267-8535 FTS 8-267-8535

DESCRIPTION/OUTPUT: Develop technical data to support the FAA goal of enhancing aircraft and operational safety through minimizing

rotorcraft accidents involving collisions with ground obstructions. Conduct accident analyses to develop necessary profile data and information which can be used to support issuance of guidance and regulatory material. Conduct systems and equipment investigations to support certification requirements. Evaluate operational procedures and piloting techniques necessary for avoiding obstacles while still adhering to appropriate ATC requirements as dictated by meteorological conditions.

Start date: 3/89

Completion date: Current projects run through 12/92.

Rotorcraft ATC Development

Project Number: ARD-82-020-I

Contact: Dean Resch ARD-30

Phone#: 202-267-8514 FTS 8-267-8514

DESCRIPTION/OUTPUTS: Develop new and/or revised procedures and standards for managing the flow of rotorcraft into, through, out of, between, and within terminal areas. This effort is aimed at optimizing the NAS through more efficient and safe use of rotorcraft in VFR, SVFR, and IFR operations. Develop state-of-the-art simulation models to allow for the efficient evaluation of ATC procedures and to determine the impact these changes will have. This will facilitate the research into the integration of rotorcraft operations in the NAS terminal areas and support the analysis of ATC requirements for advanced powered lift aircraft, such as the tiltrotor.

Start Date: 5/88

Completion Date: Current work carries through 9/97

Low Altitude Communication, Navigation, and Surveillance

Project Number: ARD-82-040-I

Contact: Robert D. Smith ARD-30

Phone#: 202-267-3783 FTS 8-267-3783

DESCRIPTION/OUTPUTS: Develop methods to ascertain the cost and benefits of providing additional communication and surveillance services at low altitude. Determine locations which can be used to develop necessary data and cost information and conduct appropriate tests. Coordinate cost and benefit analyses and ensure documentation and reports support the decision process.

Start Date: 1/89

Complete Date: 5/91

RESEARCH AND DEVELOPMENT (cont.)

Heliport/Vertiport Design and Planning

Project Number: ARD-82-080-I

Contact: Robert D. Smith ARD-30

Phone#: 202-267-3783 FTS 8-267-3783

DESCRIPTION/OUTPUTS: Support the refinement process of the FAA Advisory Circular AC 150/5390-2A, Heliport Design, related to minimum airspace requirements, minimum dimensions and markings for parking, operating areas, and taxiways. Develop and conduct testing necessary to assess the impacts and requirements for tiltrotor type operations to be incorporated in vertiport designs, including passenger and cargo operations. Support the DOT Inspector General's recommendation in developing national guidelines for heliport planning by providing heliport designers and planners a better understanding of pertinent issues and factors. Develop guidance and documentation to support the design and planning for incorporating tiltrotor type aircraft in the national transportation system. This will include studies of the increased service range, intercity operations and the associated impacts and issues on vertiport designs and plans.

Start Date: 3/89

Completion Date: Current work carries through 6/93

Rotorcraft Icing

Project Number: ARD-82-100-T

Contact: Charles Masters ACD-220

Phone#: 609-484-4140 FTS 8-482-4140

DESCRIPTION/OUTPUTS: Define the on-ground and flight hazards associated with environmental icing. Develop technological and procedural bases including the latest technological advances to facilitate aircraft icing certification. Tasks encompass atmospheric characteristic characterization, ground deicing, and icing protection.

Start Date: 6/80

Completion Date: 12/93

Rotorcraft Crashworthiness/Structural Airworthiness

Project Number: ARD-82-110-T

Contact: Lawrence Neri ACD-220

Phone#: 609-484-4459 FTS 8-482-4459

DESCRIPTION/OUTPUTS: To develop comparable level of safety between composite and metal structures in survivable impacts. This involves innovative application of composite materials to the design of a subfloor structure to reduce occupant forces in the event of an impact.

Start Date: 10/84

Completion Date: 9/89 [complete]

Rotorcraft Atmospheric Electrical Hazards

Project Number: ARD-85-130-T

Contact: Michael Glynn ACD-230

Phone#: 609-484-4130 FTS 8-482-4130

DESCRIPTION/OUTPUTS: Develop/validate lightning simulation techniques for design/certification. Develop for distribution to design/manufacturing/certification/maintenance personnel a comprehensive handbook on lightning protection of aircraft. Compile a worldwide data base on Aircraft Lightning Strikes User Manual for AC 20-53A (Protect Fuel Systems vs. Lightning).

Start Date: 9/86

Completion Date: complete [12/89]

Rotorcraft Simulator Standards

Project Number: ARD-85-140-P

Contact: Dean Resch ARD-30

Phone#: 202-267-8514 FTS 8-267-8514

DESCRIPTION/OUTPUT: Develop rotorcraft simulator certification criteria which allow for simulators to more accurately depict visual and motion cues as well as field of view requirements for rotorcraft operations. Determine the extent that rotorcraft simulator time lag affects pilot control. Determine simulator requirements and validation for low speed and low visibility certification of aircraft.

Start Date: 3/87

Complete Date: 9/95

Rotorcraft Voice Technology

Project Number: ARD-85-150-P

Contact: Dean Resch ARD-30

Phone#: 202-267-8514 FTS 8-267-8514

DESCRIPTION/OUTPUT: Develop guidance for the use of interactive voice systems in rotorcraft and tiltrotor cockpits and performance criteria for the certification of such systems. Assess the pilot workload impact during periods of high cockpit workloads and determine the potential accident prevention and safety benefits.

Start Date: FY1992

Completion Date: [Indefinite]